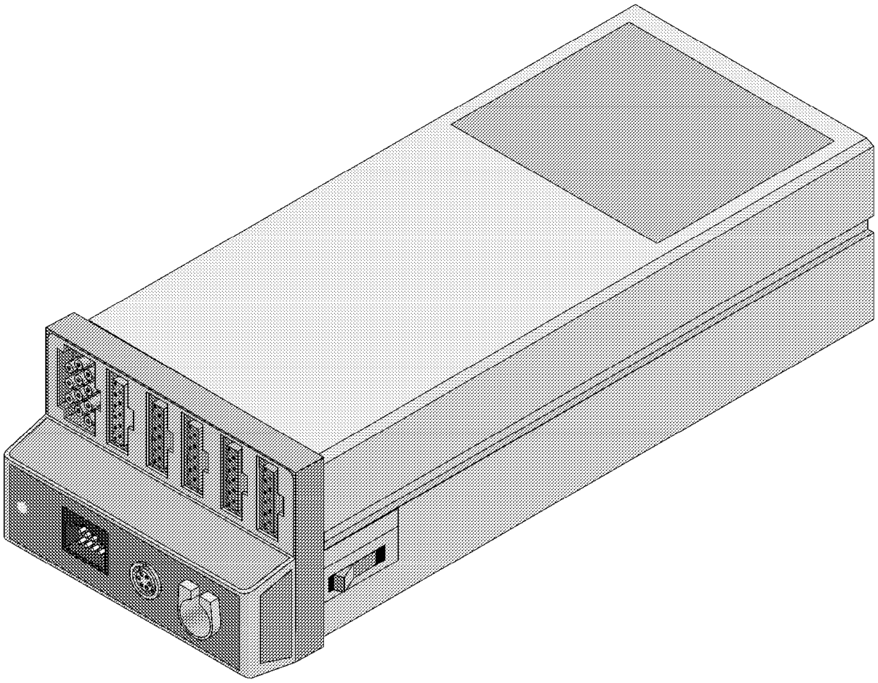
Tram® 100-850 A and SL Modules Service Manual



marquette®

Note:

Due to continuing product innovation, specifications in this manual are subject to change without notice.

Trademarks

Trademarked names appear throughout this document. Rather than list the names and entities that own the trademarks or insert a trademark symbol with each mention of the trademarked name, the publisher states that it is using the names only for editorial purposes and to the benefit of the trademark owner with no intention of improperly using that trademark.

APEX, AQUA-KNOT, ARCHIVIST, BABY MAC, CASE, CD TELEMETRY, CENTRA, CRG PLUS, EAGLE, LASER SXP, LASER-LINK, MAC, MAC-LAB, MACTRODE, MARQUETTE, MARQUETTE UNITY NETWORK, MAX, MEI, MEI in the circle logo, MINNOWS, MUSE, PRESSURE-SCRIBE, RAMS, SEER, SOLAR, ST GUARD, TRAM, TRAM-NET, TRAM-RAC, TRAMSCOPE, TRIM KNOB, UNITY NETWORK, and UNITY NETWORK twist are trademarks of Marquette Electronics, registered in the United States Patent and Trademark Office.

12SL, 15SL, ADVANTAGE, AUTOSEQ, BODYTRODE, CARDIOSERV, CARDIOSMART, CARDIOSYS, CD TELEMETRY®-LAN, CENTRALSCOPE, EDIC, FLEX, HI-RES, IMAGE VAULT, INTER-LEAD, LIFEWATCH, MARQUETTE® RESPONDER, MARS, MENTOR, MRT-II, MULTI-LINK, O_2SENSOR, OnlineABG, PRES-R-CUFF, SAM, SILVERTRACE, SMART-PAC, and SMARTLOOK are trademarks of Marquette Electronics.

© 1996 Marquette Electronics, Inc. All rights reserved.

CONTENTS

1

INTRODUCTION 1-1

Manual Information 1-2
    Revision History 1-2
    Manual Purpose 1-3
    Chapter Content 1-3
        Introduction 1-3
        General Information 1-3
        Troubleshooting 1-3
        Calibration 1-3
        Preventive Maintenance 1-3
        Connections 1-3
        Upper Assemblies 1-3
        Acquisition Modules 1-3
        NBP Assembly 1-3
        PCB Assemblies 1-3
    Related Manuals 1-4
    Tech Memos 1-4
    BBS Tech Memo Service 1-4

Safety Information 1-5
    Responsibility of the Manufacturer 1-5
    Intended Use 1-5
    Equipment Symbols 1-6
    Notes, Cautions, and Warnings 1-7

Service Information 1-8
    Service Requirements 1-8
    Equipment Identification 1-8
    Warranty 1-8

How to Reach Us... 1-9
    Ordering Supply Items 1-9
    Ordering Service Parts 1-9
    Service Calls 1-9
        Service Contracts 1-9
    Technical Support 1-10
        For All Hardware 1-10
        Telemetry 1-10
        Series 3000, 7000/7010 1-10
        48-Hour Turnaround Repair 1-10
        Service Address 1-10
    For Additional Information 1-10

2 GENERAL INFORMATION

GENERAL INFORMATION................................ 2-1

Module Identification Chart 2-2
- Tram 100A Module 2-2
- Tram 200A & SL Modules 2-2
- Tram 250SL Module 2-2
- Tram 400A Module 2-3
- Tram 450SL Module 2-3
- Tram 500A Module 2-3
- Tram 600A & SL Modules 2-3
- Tram 650SL Module 2-4
- Tram 800A & SL Module...............................2-4
- Tram 850A & SL Module...............................2-4

System Components 2-5
- What are Tram modules?.............................2-5
- What makes each module different from each other? 2-6
- What monitors and displays connect to my Tram module? 2-7
- What is a Series 70XX-Type Patient Monitor? 2-7
- What is a Solar 7000 Patient Monitor?......................... 2-8
- What is a Solar 8000 Patient Monitor?..........................2-8
- What is a Tram-rac Housing? 2-9

Technical Specifications 2-10

Power Up 2-17
- Insert Module 2-17
- Identification 2-17
- Preparation for Use..2-17

3 TROUBLESHOOTING

TROUBLESHOOTING...................................... 3-1

General Fault Isolation 3-2
- First Things to Ask 3-2
- Visual Inspection...3-2
- Calibration 3-2

Considerations for Special Components 3-4
- CMOS Components 3-4
- Surface Mounted Components.................................... 3-5
- Plastic Leaded Chip Carriers...3-5
- Flex Circuits..3-5

Troubleshooting Procedure 3-6

Service Messages 3-9

Theory of Operation 3-10
  Overall Theory 3-10
    DAS Module 3-10
    Acquisition Processor PCB 3-10
    Isolated Power Supply PCB 3-10
    Power Supply PCB 3-10
    Non-Isolated Input PCB 3-11
    Power Indicator PCB 3-11
    Fan PCB 3-11
    NBP Valve Assembly 3-11
    NBP PCB 3-11
    Pulse Oximetry PCB 3-12
  Module Processor PCB 3-13
    Versions 3-13
    Overview 3-13
    Main Microprocessor 3-13
    Communication Controller 3-16
    DEFIB SYNC Interface 3-17

4 **CALIBRATION.......... 4-1**

Adjustments, Jumpers, and Switches 4-2

Power Supply PN 401309 4-3
  Clock Frequency Calibration 4-3

Isolated Power Supply PCB PN 402329 4-4
  +5-Volt Isolated Output Calibration 4-4

Module Processor PCB PN 800210 4-5
  Switches and Jumpers 4-5
  Switches for Versions 001/002 4-6
  Switches for Versions 005 Only 4-7
  Real-Time Clock Calibration 4-8
  Battery Low Voltage Trip-Point Calibration 4-9

Acquisition Processor PCB PN 800330 4-10
  Analog-to-Digital Converter Calibration 4-10

Acquisition Processor PCB PN 801040 4-11
  Analog-to-Digital Converter Calibration 4-11

NBP Calibration 4-12
  Accuracy 4-12
  Frequency 4-12
  Special Equipment/Tools 4-12
  Preparation 4-13
  Two Procedures 4-13
    NBP Test for Tram Critical Care Monitors 4-15
    NBP Test for Series 70XX Monitors 4-21

Software Update Procedure 4-22
    Required Special Tools/Equipment 4-22
    Interconnection 4-22
    PC Setup 4-23
    Generic Procedure 4-23
    Completion 4-25

5 PREVENTIVE MAINTENANCE 5-1

Equipment Maintenance Program 5-3
    Recommended Maintenance Schedule 5-3
    Recommended Frequency 5-3

Inspection and Cleaning 5-4
    Visual Inspection 5-4
    Cleaning Precautions 5-4
    Exterior Cleaning 5-4

Checkout Procedure 5-5
    Test Frequency 5-5
    Required Tools/Special Equipment 5-5
    General Test 5-8
    Parameter Tests 5-8
    ECG Test 5-9
    12SL ECG Test 5-11
    Respiration Test 5-12
    Blood Pressure Test 5-13
    Temperature Test 5-14
    Cardiac Output Test 5-15
    SpO_2 Test 5-16
    NBP Tests 5-18
        NBP Test for Tram Critical Care Monitors 5-20
        NBP Test for Series 70XX Monitors 5-24
    DEFIB SYNC Test 5-25
    Fan Test 5-26
    Transport Test 5-26
    Completion 5-26

Domestic Electrical Safety Tests 5-27
    Test Frequency 5-27
        Required Tests 5-27
        Test Conditions 5-27

AC Line Voltage Test 5-28
        120 VAC, 50/60 Hz 5-28
        240 VAC, 50/60 Hz 5-28

Ground Continuity Test 5-29

Current Leakage Tests 5-30
Preparation 5-30
Required Tools/Equipment 5-30
Current Limits 5-31
Patient-Cable-Leakage to-Ground Test........................5-31
Patient-Cable-Leakage-into-Patient Leads Test 5-33
Completion 5-34

Hi-Pot Tests 5-35
Preparation 5-35
Test Frequency..5-35
Required Tools/Equipment 5-35
Generator Setup 5-36
Ground Connection..5-36
High Voltage Connection 5-36
AC Hi-Pot Test.. 5-37
DC Hi-Pot Test 5-38

Repair Log/PM Inspection Form 5-39

6

CONNECTIONS 6-1

External Connectors 6-2
Blood Pressure Connector 6-2
DEFIB SYNC Signals 6-3
Display Connector... 6-4
ECG/RESP Connector..6-5
Rear Connector 6-5
MEI/Nellcor SpO_2 Connector...................................... 6-7
Ohmeda SpO_2 Connector 6-8
TEMP/CO Connector... 6-9

7

TRAM 100A MODULE PN 408000...................... 7-1

General 7-2
Circuit Boards...7-2
Tram 100A Configurations 7-2

Exploded View PN 408000C 7-3

Schematic Diagram PN 408000C 7-5

Parts List PN 408000C 7-7

Assembly Revisions PN 408000...7-9

8 **TRAM 200A/SL MODULE PN 408001/411160 .... 8-1**

General 8-2
    Circuit Boards 8-2
    Tram 200A Configurations......................................8-2

Exploded View PN 408001C 8-3

Schematic Diagram PN 408001C 8-5

Parts List PN 408001C 8-8

Assembly Revisions PN 408001.....................................8-11

Exploded View PN 411160-001H 8-12

Schematic Diagram PN 411160-001H 8-14

Parts List PN 411160-001H 8-17

Assembly Revisions PN 411160.....................................8-20

9 **TRAM 250SL MODULE PN 412651 .... 9-1**

General 9-2
    Circuit Boards 9-2

Exploded View PN 412651-001H 9-3

Schematic Diagram PN 412651-001H 9-5

Parts List PN 412651-001H 9-7

Assembly Revisions PN 412651 9-10

10 **TRAM 400A/SL MODULE PN 410496/411161 .... 10-1**

General 10-2
    Circuit Boards 10-2

Exploded View PN 410496-001D 10-3

Schematic Diagram PN 410496-001D 10-4

Parts List PN 410496-001D 10-7

Tram 400A Module Assembly Revisions 10-9

Exploded View PN 411161-001J 10-10

Schematic Diagram PN 411161-001J 10-12

Parts List PN 411161-001J 10-14

Assembly Revisions PN 411161 10-17

11 **TRAM 450SL MODULE PN 412654 .... 11-1**

General 11-2
    Circuit Boards 11-2

Exploded View PN 412654-001H 11-3

Schematic Diagram PN 412654-001H 11-5

Parts List PN 412654-001H 11-7

Assembly Revisions PN 412654 11-10

12 **TRAM 500A MODULE PN 408003 .... 12-1**

General 12-2
    Circuit Boards 12-2
    Tram 500A Configurations 12-2

Exploded View PN 408003C 12-3

Schematic Diagram PN 408003C 12-5

Parts List PN 408003C 12-7

Assembly Revisions PN 408003 12-9

13

TRAM 600A/SL MODULE PN 408004/411163 13-1

General 13-2
    Circuit Boards 13-2
    Tram 600A Configurations 13-2

Exploded View PN 408004C 13-3

Schematic Diagram PN 408004C 13-5

Parts List PN 408004C 13-7

Assembly Revisions PN 408004 13-9

Exploded View PN 411163-001J 13-10

Schematic Diagram PN 411163-001J 13-12

Parts List PN 411163-001J 13-14

Assembly Revisions PN 411163 13-16

14

TRAM 650SL MODULE PN 412656 14-1

General 14-2
    Circuit Boards 14-2

Exploded View PN 412656-001H 14-3

Schematic Diagram PN 412656-001H 14-5

Parts List PN 412656-001H 14-7

ssembly Revisions PN 412656 14-9

15 **TRAM 800A/SL MODULE PN 411080/411024 .... 15-1**

General 15-2
    Circuit Boards 15-2

Exploded View PN 411080-001J 15-3

Schematic Diagram PN 411080-001J 15-5

Parts List PN 411080-001J 15-7

Assembly Revisions PN411080 15-10

Exploded View PN 411024-001J 15-12

Schematic Diagram PN 411024-001J 15-14

Parts List PN 411024-001J 15-16

Assembly Revisions PN 411024 15-19

16 **TRAM 850A/SL MODULE PN 412657/412658 .... 16-1**

General 16-2
    Circuit Boards 16-2

Exploded View PN 412657-001H 16-3

Schematic Diagram PN 412657-001H 16-5

Parts List PN 412657-001H 16-7

Assembly Revisions PN 412657 16-10

Exploded View PN 412658-001H 16-12

Schematic Diagram PN 412658-001H 16-14

Parts List PN 412658-001H 16-16

Assembly Revisions PN 412658 16-19

17

100/200 ACQUISITION MODULE PN 408134/411166/417120............................ 17-1

General 17-2
    Safety 17-2
    Assembly Configurations 17-2

Exploded View PN 418134-001A/002A 17-3

Schematic Diagram PN 408134-001A/002A 17-4

Parts List PN 408134-001A/002A 17-5

Exploded View PN 411166-001B 17-6

Schematic Diagram PN 411166-001B 17-7

Parts List PN 411166-001B 17-8

Exploded View PN 417120-001B 17-9

Schematic Diagram PN 417120-001B 17-10

Parts List PN 417120-001B 17-11

18

400 ACQUISITION MODULE PN 410495/411167/417121............................ 18-1

General 18-2
    Safety 18-2
    Assembly Configurations 18-2

Exploded View PN 410495-001D 18-3

Schematic Diagram PN 410495-001D 18-4

Module Parts List PN 410495-001D 18-5

Exploded View PN 411167-001C 18-6

Schematic Diagram PN 411167-001C 18-7

Parts List PN 411167-001C 18-8

Exploded View PN 417121-001B 18-9

Schematic Diagram PN 417121-001B 18-10

Parts List PN 417121-001B 18-11

19

500/600 ACQUISITION MODULE PN 408133/411168/416122

PN 408133/411168/416122 19-1

General 19-2
    Safety 19-2
    Assembly Configurations 19-2

Exploded View PN 408133-001A/002A 19-3

Schematic Diagram PN 408133-001A/002A 19-4

Parts List PN 408133-001A/002A 19-5

Exploded View PN 411168-001C 19-6

Schematic Diagram PN 411168-001C 19-7

Parts List PN 411168-001C 19-8

Exploded View PN 417122-001B 19-9

Schematic Diagram PN 417122-001B 19-10

Parts List PN 417122-001B 19-11

20

800 ACQUISITION MODULE PN 411068/411025/417123/417124

PN 411068/411025/417123/417124 20-1

General 20-2
    Safety 20-2
    Assembly Configurations 20-2

Exploded View PN 411068-001C 20-3

Schematic Diagram PN 411068-001C 20-4

Parts List PN 411068-001C 20-5

Exploded View PN 411025-001C 20-6

Schematic Diagram PN 411025-001C 20-7

Parts List PN 411025-001C 20-8

Exploded View PN 417123-001B/417124-001B 20-9

Schematic Diagram PN 417123-001B/417124-001B 20-10

Parts List PN 417123-001B/417124-001B 20-11

21 **NBP VALVE ASSEMBLY PN 416153 .... 21-1**

General 21-2

Exploded View PN 416153-001A 21-3

Exploded View PN 413021-001B/404459-001C 21-4

Parts List PN 413021-001B/404459-001C 21-5

22 **POWER SUPPLY ASSEMBLY PN 401309 .... 22-1**

Parts Location Diagram PN 401309-002J 22-2

Parts List PN 401309-002J 22-3

Schematic Diagram PN 401309-001F 22-5

23 **NON-ISOLATED INPUT PCB PN 401315 .... 23-1**

Parts Location Diagram PN 401315-003D 23-2

Parts List PN 401315-003D 23-3

Schematic Diagram PN 401315-003D 23-4

24 **ISOLATED POWER SUPPLY PN 402329 .... 24-1**

Parts Location Diagram PN 402329-002N 24-2

Parts List PN 402329-002N 24-3

Schematic Diagram PN 402329-002N 24-5

25 **POWER INDICATOR PCB PN 403170/800006 .... 25-1**

Parts Location Diagram PN 403170-008B/009A/011A 25-2

Parts List PN 403170-008B/009A/011A 25-3

Schematic Diagram PN 403170-008B/009A/011A 25-4

Parts Location Diagram PN 800006-001D 25-5

Parts List PN 800006-001D 25-6

Schematic Diagram PN 800006-001D 25-7

26

FAN ASSEMBLY PN 403549 26-1

Parts Location Diagram PN 403549-002F 26-2

Parts List PN 403549-002F 26-3

Schematic Diagram PN 403549-003B 26-4

27

MODULE PROCESSOR PCB PN 800210 27-1

General 27-2

Parts Location Diagram PN 800210-005B 27-3

Parts List PN 800210-005B 27-4

Schematic Diagram PN SD800210-002B 27-7

Assembly Revisions PN 800210..27-27

Parts List PN 800210-001E/002B 27-28

Schematic Diagram PN SD800210-001C 27-31

28

NBP PCB PN 4800316 28-1

General 28-2

Parts Location Diagram PN 800316-002A 28-3

Parts List PN 800316-002A 28-5

Schematic Diagram PN SD800316-002A 28-7

Parts Location Diagram PN 800316-001C 28-9

Parts List PN 800316-001C 28-10

Schematic Diagram PN SD800316-001C 28-12

29 **ACQUISITION PROCESSOR PCB PN 801040/800330 .... 29-1**

General 29-2

Parts Location Diagram PN 801040-001A/002A 29-3

Parts List PN 801040-001A/002A 29-5

Schematic Diagram PN SD801040-001A 29-7

Assembly Configurations PN800330......................................29-19

Parts Location Diagram PN 800330B 29-20

Parts List PN 800330B 29-22

Schematic Diagram PN SD800330-001B 29-24

30 **PULSE OXIMETRY PCB PN 800674/401198 .... 30-1**

General 30-2

Exploded View PN 414409-001B 30-3

Parts List PN 414409-001C 30-4

Parts Location DiagramPN 800674-003A 30-5

Parts List PN 800674-003A 30-7

Schematic DiagramPN SD800674-003A 30-10

Assembly Revisions PN 800674 30-19

Parts Location Diagram PN 800674-001A/002B 30-20

Parts List PN 800674-001A/002B 30-22

Schematic Diagram PN SD800674-002A 30-25

1 INTRODUCTION

Manual Information **1-2**
Revision History 1-2
Manual Purpose 1-3
Chapter Content 1-3
Introduction 1-3
Equipment Overview 1-3
Maintenance 1-3
Troubleshooting 1-3
Calibration 1-3
Configuration 1-3
Upper Assembly 1-3
Related Manuals 1-4
Tech Memos 1-4
BBS Tech Memo Service 1-4

Safety Information **1-5**
Responsibility of the Manufacturer 1-5
Intended Use 1-5
Equipment Symbols 1-6
Notes, Cautions, and Warnings 1-7

Service Information **1-8**
Service Requirements 1-8
Equipment Identification 1-8
Warranty 1-8

How to Reach Us... .... **1-9**
Ordering Supply Items 1-9
Ordering Service Parts 1-9
Service Calls 1-9
Service Contracts 1-9
Technical Support 1-10
For All Hardware 1-10
Telemetry 1-10
Series 3000, 7000/7010 1-10
48-Hour Turnaround Repair 1-10
Service Address 1-10
For Additional Information 1-10

Manual Information

Revision History

Each page of this manual has a revision letter, located at the bottom of the page, that identifies its update level. This may be important if you have different updates to a manual and don't know which is the most current.

For the initial release, all pages have the revision letter A. For the first update of the manual, any changed pages receive the revision letter B. For the second update, any changed pages receive the revision letter C. The latest letter of the alphabet added corresponds to the most current revision. Notice, however, that some pages may skip revision letters, for example, jump from revision A to revision C because they did not change in revision B.

Table 8-1. Revision History

Revision	Manual PN	Date	Comment
A	404422-065	13 August 1992	Initial release of this manual for Tram 100-800
B	404422-065	3 February 1994	Updated assemblies and PCBs to latest revision
C	404422-065	15 December 1994	Incorporated Tram X50 modules
D	404422-065	8 December 1995	Added new version of processor PCB
E	404422-065	1 May 1996	Incorporated changes to data acquisition and NBP PCBs
E	404422-065	14 June 1996	Added new version of pulse oximetry PCB

Manual Purpose

This manual supplies technical information for service representative and technical personnel so they may maintain the equipment to the assembly level. Use it as a guide for maintenance and electrical repair considered field repairable.

Users of this manual are expected to have a strong background in electronics, including analog and digital circuity with microprocessor and micro-controller architecture.

Chapter Content

This manual is organized into thirty chapters, summarized as follows:

Introduction

Chapter one describes the service manual and chapter contents and provides general information on safety, service requirements, equipment symbols, and serial number identification.

General Information

Chapter two gives a description of the equipment and provides a detailed list of technical specifications.

Troubleshooting

Chapter three contains general fault information, troubleshooting procedure, and theory of operation.

Calibration

Chapter four explains how and when to adjust the equipment. It also provides information about jumper and switch settings for the pcb assemblies.

Preventive Maintenance

Chapter five describes how to maintain the equipment and keep it in good working order with a recommended maintenance schedule, cleaning guidelines, checkout procedure, and safety tests.

Connections

Chapter six describes how the Tram modules connects to other devices and describes the signals on the modules' connectors.

Upper Assemblies

Chapters seven through 16 make up the upper level assemblies part of this manual. Each of these sections describes one of the Tram 100-850 A and SL modules. Each chapter lists the parts that comprise the selected Tram module, shows exploded views to assist you in assembly, disassembly, and parts replacement, and provides an interconnection diagram that shows which signals go between the electronic parts of the assembly.

Acquisition Modules

Chapters 17 through 20 make up the acquisition modules part of this manual. Each chapter lists the parts that comprise the selected data acquisition module, shows exploded views to assist you in assembly, disassembly, and parts replacement, and provides an interconnection diagram that shows which signals go between the electronic parts of the assembly.

NBP Assembly

Chapter 21 describes the assembly that contains the noninvasive blood pressure pumps and solenoids. This chapter lists the parts that comprise the assembly, shows exploded views to assist you in assembly, disassembly, and parts replacement.

PCB Assemblies

Chapters 22 through 30 make up the pcb assemblies part of this manual. Each chapter lists the parts that comprise the selected pcb assemblies, parts location, and schematic diagrams to assist you in parts replacement and troubleshooting to a component level. Updated data describing revisions to the circuit boards and major assemblies is also included, if applicable.

Related Manuals

Check these documents if you need additional information on the Solar Patient Monitoring system.

Table 8-2. Service Documents

Part Number	Name
404422-052	Tram 100-600 Hybrid Reference Manual
404183-094	Tramscope 12 Monitor Service Manual
404183-048	Tramscope 12C Monitor Service Manual
414993-001	Solar 7000/8000 Field Service Manual
414993-007	Solar 7000/8000 Data Manual
404183-096	Tram-rac Housing Service Manual
404183-150	Modular Monitor Accessories Service Manual
403799-010	Tram Critical Care Monitoring System Mounting Reference Guide
403799-016	Tram X00 Modules/Eagle Monitor Termination Instructions for BP, CO, and Temp Cables

Table 8-3. Operator Documents

Part Number	Name
404422-103	Tram Smart-pac Display Operator's Manual
404183-176	Tram Critical Care Monitor Operator's Manual
414993-031	Solar 7000/8000 Patient Monitor Operator's Manual
403799-023	Marquette Unity Network User's Manual

Tech Memos

Marquette Service issues technical memos that aid service personnel in servicing and maintaining the equipment. Tech Memos supply important information about changes to the equipment, typical problems, and how to solve those problems. Tech Memos are also written to describe hardware and software upgrades.

Tech Memos are automatically distributed to all Marquette Field Service personnel, and are available to customers by subscription. Contact Technical Support for more information or to subscribe. For the address or telephone number, see the “How to Reach Us...” pages presented later in this manual.

BBS Tech Memo Service

Designed primarily for biomedical technicians, the BBS Tech Memo Service provides “instant” on-line access to the latest MEI maintenance and repair information. Subscribers with an IBM or IBM-compatible computer and modem can link-up to the MEITIS system and download technical publications as well as send and receive messages from technical support representatives. Call Service Contracts at 800-552-3248 for subscription information.

Safety Information

Responsibility of the Manufacturer

Marquette Electronics, is responsible for the effects of safety, reliability, and performance only if:

- Assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by Marquette.
- The electrical installation of the relevant room complies with the requirements of the appropriate regulations.
- The equipment is used in accordance with the instructions for use.

Intended Use

This device is intended for use under the direct supervision of a licensed health care practitioner.

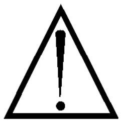
To ensure patient safety, use only parts and accessories manufactured or recommended by Marquette Electronics.

Contact Marquette Electronics for information before connecting any devices to this equipment that are not recommended in this manual.

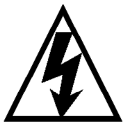
Equipment Symbols

The following symbols appear on the equipment.

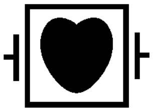
NOTE: Some symbols may not appear on all equipment.



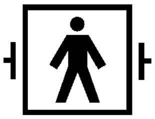
ATTENTION: Consult accompanying documents before using the equipment.



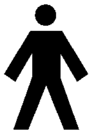
In Europe, this symbol means dangerous or high voltage. In the United States, this symbol represents the caution notice below: To reduce the risk of electric shock, do NOT remove cover (or back). Refer servicing to qualified personnel.



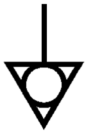
Defibrillator-proof type CF equipment; type CF equipment is specifically designed for applications where a conductive connection directly to the heart is established. The paddles indicate the equipment is defibrillator proof.



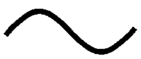
Defibrillator-proof type BF equipment; type BF equipment is specifically designed for applications intentional external and internal application to the patient, excluding direct cardiac application. Type BF equipment is type B equipment with an F-type isolated (floating) part. The paddles indicate the equipment is defibrillator proof.



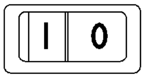
Type B equipment; type B equipment is suitable for intentional external and internal application to the patient, excluding direct cardiac application.



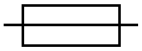
Equipotentiality



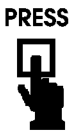
Alternating current (AC)



Power; **I** = ON; **O** = OFF



Fuse



Indicates where to press to open the door on the Series 7160 Direct Digital Writer.

Notes, Cautions, and Warnings

Notes, cautions, and warnings are used in this manual to provide additional information to service personnel.

NOTE
A note conveys special instructions to service personnel to highlight an operating procedure, practice, etc. Notes may precede or follow the applicable text, depending on the material to be highlighted.

CAUTION
The purpose of a caution is to inform service personnel of an operating procedure, practice, etc., which if not strictly observed, could result in possible damage to the equipment. Cautions always precede the applicable text.

WARNING
A warning provides instructions to service personnel that if an operating procedure, practice, etc., is not followed, personal injury may result. Warnings always precede the applicable text.

Service Information

Service Requirements

Follow the service requirements listed below.

- Refer equipment servicing to Marquette Electronic's authorized service personnel only.
- Any unauthorized attempt to repair equipment under warranty voids that warranty.
- It is the user's responsibility to report the need for service to Marquette Electronics or to one of their authorized agents.
- Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
- Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.

Equipment Identification

Every Marquette Electronics device has a unique serial number for identification. The serial number appears on the product label on the base of each unit under the Trim knob control.

D 1 XX 0005 G XX

Month Manufactured	**Year Manufactured**	**Product Code**	**Product Sequence Number**	**Division**	**Device Characteristics**
A = January B = February C = March D = April E = May F = June G = July H = August J = September K = October L = November M = December	1 = 1991 2 = 1992 3 = 1993 (and so on)	Two-character product descriptor	Manufacturing number (of total units manufactured.)	F = Cardiology G = Monitoring	One or 2 letters that further describe the unit, for example: P = prototype not conforming to marketing specification R = refurbished equipment S = special product documented under Specials part numbers U = upgraded unit

Warranty

1 year.

How to Reach Us…

The following are telephone numbers and addresses for contacting various Marquette Electronics Service and Supplies Division personnel.

Ordering Supply Items

Supply items are generally items used during normal operation of a product. Leadwires, electrode paste, patient cables, and printer paper are examples of supply items.

Make telephone inquiries about supply items at:

1-800-558-5102

Address orders or inquiries to:

Marquette Electronics Service and Supplies
P.O. Box 9100
100 Marquette Drive
Jupiter, FL 33468-9100
Attn: Supplies

Ordering Service Parts

Service parts are items that are not expended in the normal operation of the product. They are generally replacements for defective or malfunctioning items inside the product. Service parts include PCB assemblies, electronic components, internal cables and harnesses, software or firmware, and operator and service manuals. When ordering additional operator manuals, remember to notate the software version from the start-up screen.

A part number for the item to be replaced is necessary for ordering a service part. If the part number for the desired item is unobtainable, the following will be necessary to order the item:

- model and serial number of the equipment,
- part number/name of the assembly where the item is used,
- item name, and
- where applicable, reference designation (eg, R13, S12, U32).

Service Calls

To open a service call with Marquette Electronics Service, contact a Service Dispatcher at:

1-800-558-7044 (U.S. only)

1-407-575-5000 (outside the U.S.)

Service Contracts

For any questions about Service Contracts, contact the service contract operator at:

1-800-552-3248

Technical Support

Technical Support has the most current information about your equipment and can provide assistance with any technical questions or problems.

For All Hardware

For technical advice concerning any equipment in your Marquette Electronics monitoring system, contact Tech Support—Monitoring Hardware at:

1-800-558-7822

Telemetry

For technical advice concerning your Telemetry system, contact Tech Support—Telemetry at:

1-800-552-3243

Series 3000, 7000/ 7010

For technical advice concerning Series 3000, 7000/7010 patient monitoring equipment, contact Tech Support:

1-800-443-0980

48-Hour Turnaround Repair

Some Marquette products (Input Modules, Tram modules, Series 7700 ECG Telemetry Transmitters, and CD Telemetry Transmitters) are repaired on a 48-hour turnaround basis.

To inquire about status of 48-hour turnaround repair items, or if you have questions before shipping an assembly to be repaired, call:

1-800-552-3243

Service Address

Send items for 48-hour repair and all monitoring repair items to:

Marquette Electronics Service and Supplies
P.O. Box 9100
100 Marquette Drive
Jupiter, FL 33468-9100
Attn: Monitoring Repair

For Additional Information

The main switchboard operator will direct your call to the person most able to assist you. For any other questions or problems, contact the main switchboard operator at:

1-800-558-5120

2 GENERAL INFORMATION

Module Identification Chart **2-2**
Tram 100A Module 2-2
Tram 200A & SL Modules 2-2
Tram 250SL Module 2-2
Tram 400A Module 2-3
Tram 450SL Module 2-3
Tram 500A Module 2-3
Tram 600A & SL Modules 2-3
Tram 650SL Module 2-4
Tram 800A & SL Module 2-4
Tram 850A & SL Module 2-4

System Components **2-5**
What are Tram modules? 2-5
What makes each module different from each other? 2-6
What monitors and displays connect to my Tram module? 2-7
What is a Series 70XX-Type Patient Monitor? 2-7
What is a Solar 7000 Patient Monitor? 2-8
What is a Solar 8000 Patient Monitor? 2-8
What is a Tram-rac Housing? 2-9

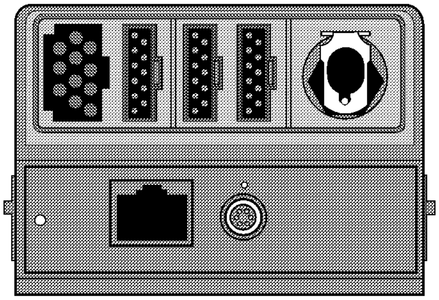
Technical Specifications **2-10**

Power Up **2-17**
Insert Module 2-17
Identification 2-17
Preparation for Use 2-17

Module Identification Chart

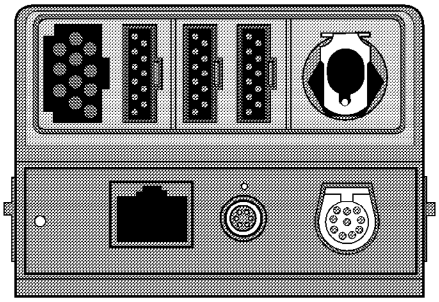
Many different module assemblies are available and many have had label changes for the same module. Below is a chart to help match the module assembly visually with its proper part number. The left column will show the different module fronts for each module type described in this manual. The right column will give all part numbers for easy access in this manual.

Tram 100A Module



Tram 100A Module PN 408000-001 through 408000-018
Refer to Chapter 7 for more details.

Tram 200A & SL Modules

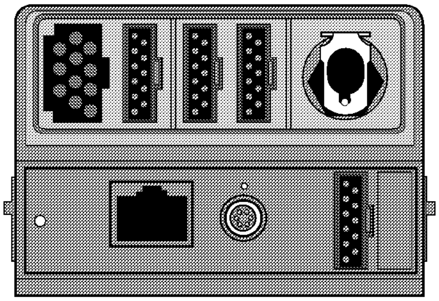


Tram 200A Module PN 408001-001 through 408000-018
Refer to Chapter 8 for more details.

Tram 200SL Module PN 408001-001
Refer to Chapter 8 for more details.

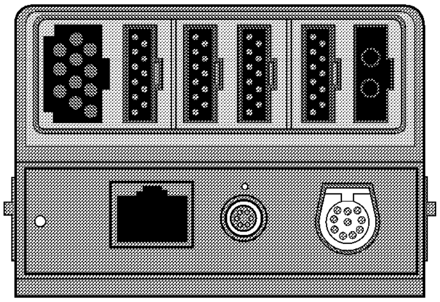
NOTE
The two modules listed above use a pulse oximetry PCB manufactured by Ohmeda, Inc.

Tram 250SL Module



Tram 250SL Module PN 412651-001
Refer to Chapter 9 for more details.

Tram 400A Module

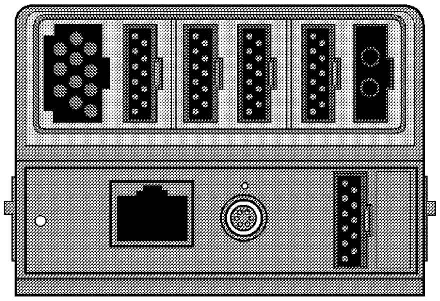


Tram 400A Module PN 408975-001
Refer to Chapter 10 for more details.

Tram 400SL Module PN 411161-001
Refer to Chapter 10 for more details.

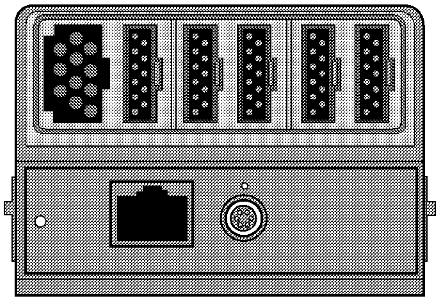
NOTE
The two modules listed above use a pulse oximetry PCB manufactured by Ohmeda, Inc.

Tram 450SL Module



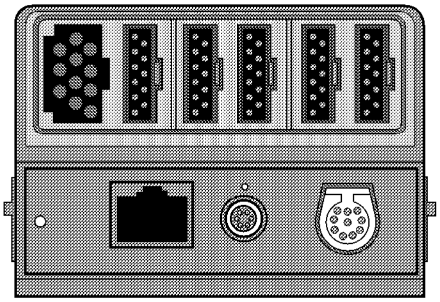
Tram 450SL Module PN 412654-001
Refer to Chapter 11 for more details.

Tram 500A Module



Tram 500A Module PN 408003-001 through 408003-018
Refer to Chapter 12 for more details.

Tram 600A & SL Modules

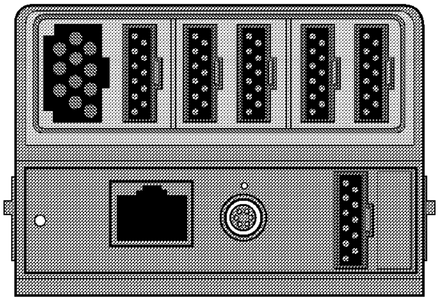


Tram 600A Module PN 408004-001 through 408003-018
Refer to Chapter 13 for more details.

Tram 600SL Module PN 411163-001
Refer to Chapter 13 for more details.

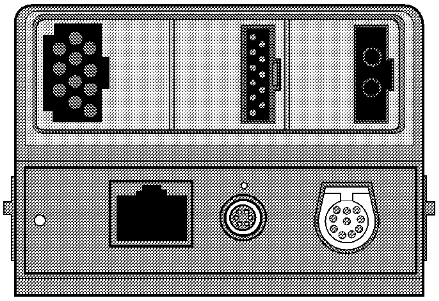
NOTE
The two modules listed above use a pulse oximetry PCB manufactured by Ohmeda, Inc.

Tram 650SL Module



Tram 650SL Module PN 412656-001
Refer to Chapter 14 for more details.

Tram 800A & SL Modules

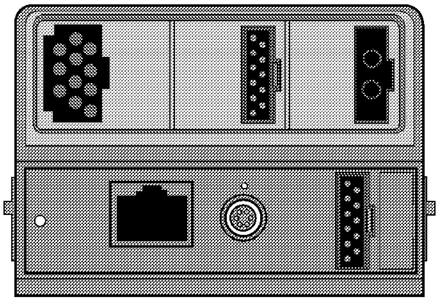


Tram 800A Module PN 411080-001
Refer to Chapter 15 for more details.

Tram 800SL Module PN 411024-001
Refer to Chapter 15 for more details.

NOTE
The two modules listed above use a pulse oximetry PCB manufactured by Ohmeda, Inc.

Tram 850A & SL Modules



Tram 850A Module PN 412657-001
Refer to Chapter 16 for more details.

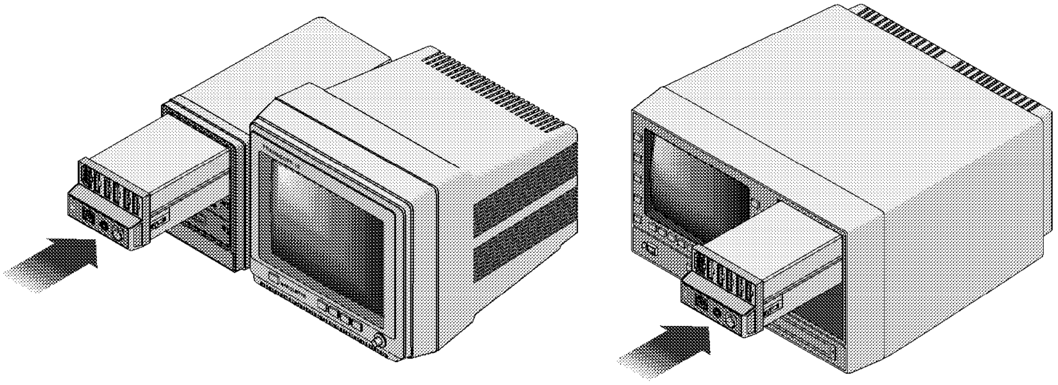
Tram 850SL Module PN 411658-001
Refer to Chapter 16 for more details.

System Components

What are Tram modules?

The Tram 100-850 A and SL modules are plug-in/pull-out modules used in Marquette monitoring systems and transport displays. The Tram 100-850 A and SL modules (hereafter referred to, collectively, as Tram modules) collect data from a patient, convert the data to a digital form for processing and send the data to a bedside or surgical monitor, or a transport display for further processing and display. The data that a Tram module collects, converts and sends includes the patient's vital signs and physiological waveforms.

The Tram module also stores a patient history including trends and special events, and setup information like blood pressure zero points and alarm limit settings. The patient history is stored so that when a patient is transferred to a different monitor, the collected information is transferred with them.



The following modules are *not* described in this manual and have their own service manual.

Table 2-1. Other Module Service Manuals

Module	Part Number
BP/CO/Temperature Input Modules	403798-005
ABG Module	412383-003
Pulse Oximetry Module	700-9573-002
Solar ECG Module	414993-032
Solar SpO_2 Module	414993-033
NBP Module	414993-059
SVO_2 Module	403798-007

What makes each module different from each other?

Each series, or model, of Tram module monitors a different set of vital signs. This table lists the vital signs monitored by each model.

Table 2-2. Types of Modules

Module Series	ECG Leadwires	RESP	NBP	SpO2	CO	TEMPs	Inv BPs
Tram 100A	5	•	•		•	2	2
Tram 200A	5	•	•	•†	•	2	2
Tram 200SL	10	•	•	•†	•	2	2
Tram 250SL	10	•	•	•	•	2	2
Tram 400A	5	•	•	•†	•	2	3
Tram 400SL	10	•	•	•†	•	2	3
Tram 450SL	10	•	•	•	•	2	3
Tram 500A	5	•			•	2	4
Tram 600A	5	•		•†	•	2	4
Tram 600SL	10	•		•†	•	2	4
Tram 650SL	10	•		•	•	2	4
Tram 800A	5	•	•	•†	•	2	0
Tram 800SL	10	•	•	•†	•	2	0
Tram 850A	5	•	•	•	•	2	0
Tram 850SL	10	•	•	•	•	2	0

† The pulse oximetry connector on this Tram module is only compatible with Ohmeda manufactured probes.

What monitors and displays connect to my Tram module?

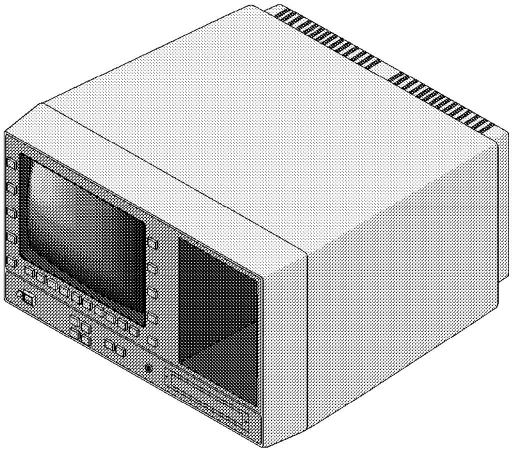
The displays and monitors listed below supply the Tram module with power, and they show the vital signs and waveforms that the Tram module collects and stores. You may use the Tram module with one of the following devices.

- Series 7005 monitor
- Series 7010 monitor
- Series 7010RA monitor
- Series 7000 or 7000RA monitor that has been modified to be Tram-compatible
- Tram Critical Care monitor (a Tramscope or Solar display equipped with any of the Tram-rac housings)
- Series 7200 Tram transport display fitted with a Smart-pac battery backpack
- Smart-pac transport display

What is a Series 70XX-Type Patient Monitor?

A Series 70XX-type patient monitor includes a Series 7000, 7000RA, 7005, 7010, or 7010RA monitor. It is an intelligent terminal, containing the display, all of the user controls, and processors to communicate with patient monitor peripherals and analyze patient data. It is capable of displaying up to four different waveforms at one time. Modules are inserted directly into the monitor housing.

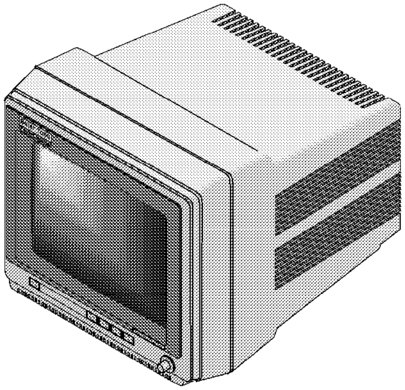
Shown below is a Series 7010 patient monitor.



What is a Solar 7000 Patient Monitor?

One Solar based patient monitor used with the input modules is the Solar 7000 patient monitor. It is an intelligent terminal, containing the display, all of the user controls, and processors to communicate with patient monitor peripherals and analyze patient data. It is capable of displaying up to six or eight different waveforms at one time. System software may be updated by a laptop computer at the monitor or through the Marquette Unity Network using a central station.

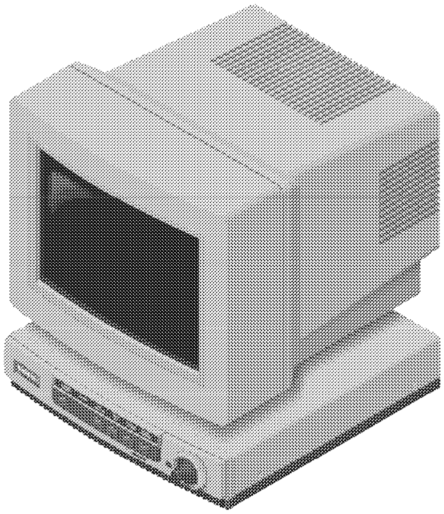
Shown below is a Solar 7000 patient monitor.



What is a Solar 8000 Patient Monitor?

The Solar 8000 patient monitor system consists of a Solar 8000 processing unit with a compatible display purchased from Marquette Electronics or another vendor. The processing unit is the center of the Solar 8000 patient monitoring system. It provides the user controls, processors to communicate with patient monitor peripherals, and analyzes patient data. It is capable of displaying up to six or eight different waveforms at one time on the compatible 12, 15, 17, or 19-inch display. System software may be updated using a laptop computer connected to the Solar 8000 processing unit or through the Marquette Unity Network using a central station.

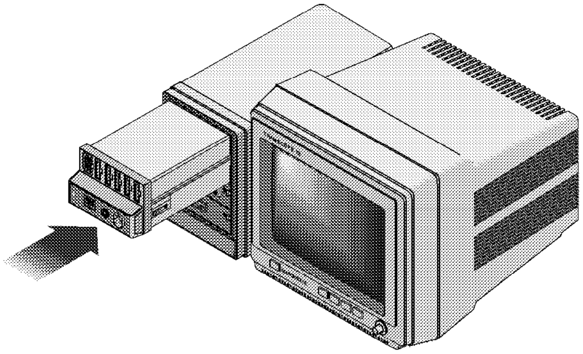
Shown below is a generic display and a Solar 8000 processing unit.



What is a Tram-rac Housing?

The Tram-rac housing (remote acquisition case) acquires patient data for the patient monitor. *The Tram-rac Housing Service Manual,* pn 404183-096, has more information.

Shown below is a Tram module inserted in a Tramscope monitor with a Tram-rac 4A housing.



Technical Specifications

Table 2-3. Physical Specifications for All Tram Modules

Item	Description
Height	8.1 cm (3.2 in)
Width	11.4 cm (4.5 in)
Depth	29.5 cm (11.6 in)
Weight	2.1 kg (4.7 lb)
Interface	Used with Tramscope or Solar monitors

Table 2-4. Environmental Specifications for All Tram Modules

Item	Description
Power requirements	16.5 VDC
Power consumption	10 watts (module alone)
Cooling	Forced air
Heat Dissipation	34 BTU
Operating conditions ■ Ambient temperature ■ Relative humidity	 10˚C to 35˚C (50˚F to 95˚F) 40% to 95% (noncondensing)
Storage conditions ■ Temperature ■ Relative humidity	 –10˚C to 50˚C (14˚F to 122˚F) 0 to 95% (non-condensing))

Table 2-5. Processing

Item	Description
Main processor	Motorola 68000, 16/32 bit, 14.75 MHz
Input/output	Intel 80C152, 8 bit, 14.75 MHz
Data acquisition	Intel 80C152, 8 bit, 14.75 MHz
SpO_2 processor	Intel 80C196, 8 bit, 7.3 MHz

Table 2-6. ECG Parameter for All Trams for All Tram Modules

Item	Description
Standard leads available ▪ Tram 100A, 200A, 400A, 500A, 600A, and 800A modules: ▪ Tram 200SL, 400SL, 600SL, and 800SL modules:	 I, II, III, V, aVR, aVL, and aVF I, II, III, V1, V2, V3, V4, V5, V6, aVR, aVL, and aVF
Leads analyzed simultaneously	Four (I, II, III, and V)
Heart rate detection range	30 to 300 beats/min
QRS detection range	0.5 mV to 5 mV
Signal width	40 ms to 120 ms (Q to S)
Common mode rejection	90 dB min
Frequency response ▪ OR ▪ Neonate ▪ Adult	 0.05 Hz to 25 Hz 0.5 Hz to 40 Hz 0.05 Hz to 100 Hz
Pacemaker detection/rejection ▪ Input voltage range ▪ Input pulse width ▪ Rise time ▪ Over/under shoot ▪ Baseline drift	 ±2 mV to ±700 mV 0.1 ms to 2 ms 10 µs to 100 µs 2 mV (max) <0.5 V with a ±700 mV, 2 ms pacemaker pulse applied
Lead fail	Identifies failed lead and switches to intact one
Analog output	Selectable @ 1 V/mV
Trends	24 hours with 1-minute resolution

Table 2-7. Respiration Parameter for All Modules

Item	Description
Rate range	1 to 200 breaths/minute
Impedance range	100 to 1000 ohms at ±52.6 kHz
Detection sensitivity range	0.4 to 10 ohms impedance variation
Low rate alarm range	1 to 199 breaths/min
High rate alarm range	2 to 200 breaths/minute
Apnea alarm rate	0 to 30 seconds in one-second increments
Cardiac artifact alarm	
Waveform display bandwidth	0.05 Hz to 2.5 Hz (–3 dB)
Analog output	Selectable
Trends	24 hours with 1-minute resolution

Table 2-8. Invasive Blood Pressure Parameter for All Tram Modules Except Tram 800 and 850 Modules

Item	Description
Catheter sites	Arterial, pulmonary arterial, central venous, left arterial, intracranial, right arterial, femoral arterial, umbilical venous, umbilical arterial, and special.
Accuracy	2% ±1 mmHg (exclusive of transducer)
Measurement range	
▪ Arterial	–98 to 350 mmHg
▪ All other sites	–98 to 350 mmHg
Zero balance range	±150 mmHg offset
Zero balance accuracy	±1 mmHg
Transducer excitation	±2.5 VDC
Transducer sensitivity	50 µV/V/cmHg
Waveform frequency response	0 Hz to 12 Hz or 0 Hz to 40 Hz (–3 dB) user-selectable
Analog output	Selectable, 1 V/100 mmHg
Trends	24 hours with 1-minute resolution

Table 2-9. Temperature Parameter for All Tram Modules

Item	Description
Number of channels	2
Probe type	YSI Series 400 or 700
Range	0˚C to 45˚C (32°F to 113°F)
Gain	121.95 ±1%
Linearity	<1% from 30˚C to 42˚C
DC drift	<1 mV/˚C
Error: ▪ YSI series 400 probes ▪ YSI series 700 probes	(Independent of source) ±0.1°C ±0.3°C
Noise	<20 mV from DC to 100 Hz
Alarms	User-selectable upper and lower limits for T1, T2
Resolution	±0.2°C
Displayed parameters	Temperature 1, Temperature 2
Trends	24 hours with 1-minute resolution

Table 2-10. Pulse Oximetry Parameter for All Tram Modules Except Tram 100 and 500 Modules

Item	Description
Saturation range	0 to 100%
SpO_2 Accuracy ■ 90% to 100% ■ 80% to 89.9% ■ 60% to 100% ■ Below 60%	 1.5% 2.1% 2.4% (overall range) Unspecified
Pulse rate range	40 to 235 beats/minute
Pulse rate accuracy	±1.7% of current reading (assumes constant pulse rate)
Displayed frequency response	1.5 to 10.5 Hz
Alarm limit range ■ SpO_2 ■ Pulse	 1% to 105% 40 to 235 beats/min
Displayed parameters	Oxygen saturation, pulse rate
Trends	24 hours with 1-minute resolution
Analog output	Selectable waveform
Analog output	Selectable saturation 0 to 100% equivalent 0 to 1 V
Messages sent to display	Interference Detected, Low Light, Check Probe, Low Signal Quality, Probe Off Patient, Replace Bad Probe, Service the Module

Table 2-11. Non-Invasive Blood Pressure Parameter for All Tram Modules Except Tram 500, 600, and 650 Modules

Item	Description
Measurement technique	Oscillometric
Displayed parameters	Systolic, diastolic, and mean pressures; time of last measurement, cuff size, countdown to next measurement
Cuff inflation rate	25 mmHg/sec (nominal)
Cycle time	Typically 20 to 40 sec (dependent on heart rate)
Maximum inflation pressure	
▪ Adult	300 mmHg
▪ Neonatal	150 mmHg
Heart rate detection	30 to 300 beats/minute
Measurement modes	Manual, auto, and stat. Stat mode is 5 minutes of continuous measurements.
Trends	96 stored events saved a maximum of 24 hours
Cuff sizes:	
▪ Disposable	Large adult (33 cm to 47 cm), adult (25 cm to 35 cm), small adult (18 cm to 26 cm), small pediatric (6 cm to 17 cm), infant (5 cm to 15 cm) and neonates (3 cm to 6 cm, 4 cm to 8 cm, 6 cm to 11 cm, 7 cm to 13 cm, and 8 cm to 15 cm)
▪ Reusable	Thigh (46 cm to 66 cm), large adult (33 cm to 47 cm), adult (25 cm to 35 cm), child (18 cm to 26 cm), infant (10 cm to 19 cm) and newborn* (6 cm to 11 cm) *Requires pn 9461-205 neonatal tubing

Table 2-12. Cardiac Output Parameter for All Tram Modules

Item	Description
Cardiac output range	0.2 to 15 liters/min
Blood temperature range	30°C to 42°C (86°F to 107°F)
Injectate temperature range	0°C to 30°C (32°F to 86°F)
Waveform display frequency response	0 Hz to 10 Hz (–3dB)
Displayed parameters	Cardiac output, blood temperature, injectate temperature, trial number
Injectate volume	3, 5, or 10 cc

Table 2-13. Certification for All Tram Modules

Item	Description
Safety limits and performance standards	Meets the requirements of ANSI/AAMI ES1
Safety standards	UL 544 listed CSA No. 125 certified IEC 601-1 certified

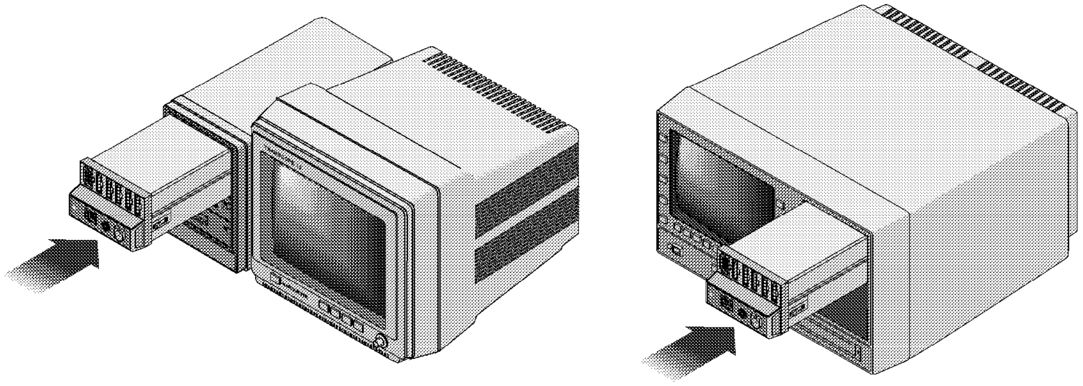
Table 2-14. Classification for All Tram Modules

Item	Description
Type of protection against electrical shock	Not applicable
Degree of protection against electrical shock	Type CF equipment
Degree of protection against harmful ingress of water	Ordinary Equipment (enclosed equipment without protection against ingress of water)
Degree of safety of application in the presence of a flammable anesthetic moisture with air or with oxygen or nitrous oxide	Equipment not suitable for using the presence of a flammable anesthetic moisture with air or with oxygen or nitrous oxide.
Method(s) of sterilization or disinfection recommended by the manufacturer	Not applicable
Mode of operation	Continuous operation

Power Up

Insert Module

Insert the module in the top slot of a Tram-rac 4 housing or Series 70XX-type.



1. Connect appropriate parameter cables
2. Apply power to the monitor. If your Tram-rac housing has its own power supply, apply power to it, too.
3. Ensure POWER indicator on the Tram module's front panel is turned ON.

Identification

After inserting the module, the module should also identify itself on the monitor screen with a patient parameter box.

If the module does not identify itself on the screen, refer to "Troubleshooting Procedure" in Chapter 5: "Troubleshooting."

Preparation for Use

Perform the following procedures, before presenting the module for service.

- Perform the "Checkout Procedure" provided in Chapter 4: "Preventive Maintenance."
- If the module fails any tests, refer to "Troubleshooting Procedure" in Chapter 5: "Troubleshooting."

For your notes

3 TROUBLESHOOTING

General Fault Isolation 3-2
    First Things to Ask...3-2
    Visual Inspection 3-2
    Calibration...3-2

Considerations for Special Components 3-4
    CMOS Components..3-4
    Surface Mounted Components.. 3-5
    Plastic Leaded Chip Carriers 3-5
    Flex Circuits..3-5

Troubleshooting Procedure 3-6

Service Messages 3-9

Theory of Operation 3-10
    Overall Theory...3-10
        DAS Module...3-10
        Acquisition Processor PCB 3-10
        Isolated Power Supply PCB 3-10
        Power Supply PCB 3-10
        Non-Isolated Input PCB 3-11
        Power Indicator PCB 3-11
        Fan PCB 3-11
        NBP Valve Assembly 3-11
        NBP PCB..3-11
        Pulse Oximetry PCB 3-12
    Module Processor PCB 3-13
        Versions..3-13
        Overview...3-13
        Main Microprocessor..3-13
        Communication Controller 3-16
        DEFIB SYNC Interface...3-17

General Fault Isolation

First Things to Ask

If the unit is not working properly, save yourself some time troubleshooting by asking yourself these basic questions.

- Is the module seated correctly?
- Is the monitor and/or Tram-rac housing power cord connected?
- Is the monitor turned ON at the rear of the monitor?
- Is the display LED illuminated? Are all the communication cables firmly connected?
- Were there any changes in the use, location, or environment of the equipment that could cause the failure?
- Has the unit been modified in any way, either in software or hardware?

Is operator error the cause of the problem? Try to repeat the user's scenario exactly and compare that to the proper operation of the equipment. Check the operator's manual as necessary.

Visual Inspection

A thorough visual inspection of the equipment can save time. Small things—disconnected cables, foreign debris on circuit boards, missing hardware, loose components—can frequently cause symptoms and equipment failures that may appear to be unrelated and difficult to track.

Take the time to make all the recommended visual checks (refer to the visual inspection chart on the next page) before starting any detailed troubleshooting procedures.

Calibration

There is very little calibration required for the input modules. If a parameter does not pass the checkout procedure provided in Chapter 3: "Preventive Maintenance," refer to the individual circuit board chapters in this manual for any PCB level calibration. In most cases, the modules should be returned to the factory for service.

Table 3-1. Visual Inspection List

Area	Look for the following problems:
I/O Connectors and Cables	■ Fraying or other damage ■ Bent prongs or pins ■ Cracked housing ■ Loose screws in plugs
Interface Cables	■ Excessive tension or wear ■ Loose connection ■ Strain reliefs out of place
Circuit Boards	■ Moisture, dust, or debris (top and bottom) ■ Loose or missing components ■ Burn damage or smell of over-heated components ■ Socketed components not firmly seated ■ Solder problems: cracks, splashes on board, incomplete feedthrough, prior modifications or repairs
Ground Wires/Wiring	■ Loose wires ■ Faulty wiring ■ Wires pinched or in vulnerable position
Mounting Hardware	■ Loose or missing screws or other hardware
Power Source	■ Faulty connection between PCBs ■ Power source problems may cause static discharge, resetting problems, and noise.

WARNING
Solder multilayer and surface mount PCB assemblies at your own risk! Improper repair methods can damage the PCB assemblies even further. Only qualified service personnel with the proper laboratory equipment should attempt to repair PCB assemblies.

Considerations for Special Components

CMOS Components

This equipment contains many CMOS components, which are less susceptible to noise and consume less power than standard TTL or NMOS components. However, CMOS components are more easily damaged by electrostatic discharge (ESD) than other semiconductors.

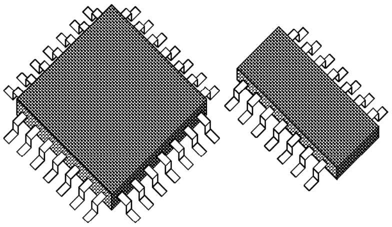
ESD damage, usually a subtle weakening of semiconductor junctions, can range from corruption of digital memory to catastrophic system failure. Although CMOS components most frequently fail from ESD damage, no semiconductor device is completely safe from ESD damage.

The inputs and outputs of all the equipment components are protected from ESD damage during normal operation. However, during servicing, these components are exposed to several sources of static electricity, ranging from human hands to improperly grounded test equipment. For this reason, all service workstations should be as static-free as possible.

The following guidelines can help reduce ESD damage to semiconductors and assemblies with semiconductors.

- Discharge any static charge you may have built up before handling static-sensitive devices.
- Wear a grounded, anti-static wristband or heel strap.
- Use only properly grounded soldering and test equipment.
- Use a static-free surface.
- Store semiconductors and static-sensitive assemblies in an anti-static container until needed.
- Always turn off the power before removing or inserting a semiconductor.
- Do not slide semiconductors or assemblies containing semiconductors across any surface.
- Do not touch semiconductor leads unless absolutely necessary.

Surface Mounted Components



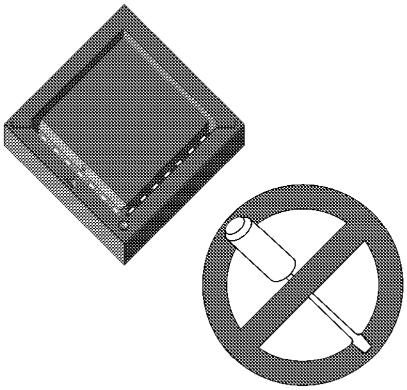
Surface mounted components are used to aid in miniaturizing the Tram 100-850 A and SL modules.

Surface mounted integrated circuits have legs that are soldered to rectangular pads on the surface of the circuit board, rather than having legs that are made to be inserted into holes that go through the circuit board. Surface mounted integrated circuits can have legs on either two or four sides of the chip.

Surface mounted resistors, capacitors, and diodes usually have no legs at all – conductive parts of their bodies are soldered directly to the circuit board.

CAUTION
Surface mounted components were not designed to be removed and replaced with standard soldering equipment. Removing a surface mounted component with a conventional soldering iron could destroy the circuit board. Special equipment is required to remove and replace these items.

Plastic Leaded Chip Carriers



Plastic leaded chip carriers (PLCCs) are also used in the Tram 100-850 A and SL modules to aid in miniaturizing the equipment.

They are integrated circuits that have “loops” on four sides that make contact with a socket or they are soldered directly to the PCB.

CAUTION
PLCCs require special care, and some special tools when they are removed. If you attempt to remove a PLCC from its socket with a screwdriver, you are likely to damage both the PLCC and its socket. A Burndy QILEXT-1 or equivalent extractor must be used to remove a PLCC from its socket.

Flex Circuits

The Tram modules use flex circuits to route signals between pcb assemblies. Flex circuits are intended to flex very small amounts. If you force them to flex very far out of their normal range of motion, they will fail. Take extreme care not to disturb flex circuits more than is absolutely necessary when you service the Tram module, especially when removing and replacing circuit boards that are connected with flex circuits.

Troubleshooting Procedure

To use this troubleshooting procedure, read through the steps in the table until you find a similar problem to the one you are having. Do not perform any invasive procedures listed in this procedures unless you are a trained field or bio-medical engineer.

WARNING
This procedure is intended for use by service personnel with advanced troubleshooting skills. The consequences of the following steps may cause loss of patient data and disruption of the entire Marquette Unity Network.

Table 3-2. Troubleshooting Chart

Does the power indicator turn on? Yes No	This problem has may sources, so try one or more of the following solutions.
	1. If the power indicator fails to turn on, and the monitor has no communications with the Tram module, it means that power isn't making it all the way from the monitor to the module processor PCB. 2. Verify monitor is functional. Most of the time, a failure of this sort is caused by a faulty power supply PCB, pn 401309-002. Try swapping the one in your module with a known-good one.

Table 3-2. Troubleshooting Chart

Does the diagnostic indicator turn on? Yes No	The Tram module has one diagnostic indicator: dual-color light-emitting diode DS1, located on the bottom of the module processor PCB, pn 800210-00x. It is referred to as the "I AM OK" light. Follow these steps to view the indicator in action.
	1. Remove the module cover (item 1 in the exploded views listed in chapters 7 through 16). 2. Turn the Tram module upside-down. 3. Apply power to the Tram module. The easiest way to do this is to connect a Smart-pac-equipped transport display to the front panel connector of the Tram module, but a better way is to use an extender board to connect it to a monitor.
	You can see the diagnostic indicator between the power supply PCB and the bottom chassis ground plate. Watch it while you apply power. If the Tram module is "healthy", it: ■ glows red until the communication controller on the module processor gets up and running, ■ flashes between green and red a couple of times while the main microprocessor on the module processor PCB boots, and then ■ steadily glows green until external power is removed.
	If the module runs into trouble, it's likely that one of the following is true. ■ The diagnostic indicator *never flashes* at all when the power is applied. Try replacing the module processor PCB. ■ The diagnostic indicator *stays steady red.* Sometimes the pulse oximetry PCB causes this condition. Try disconnecting it and powering the module again. If that doesn't do it, try replacing the module processor PCB. ■ The diagnostic indicator *stays flashing red/green.*
Does the fan turn on? Yes No	When you insert the module into a monitor, it tries to establish communications with the monitor. The next step, when the module's sure that it is in a monitor, and not just connected to a transport display, is to turn on its fan. If the diagnostic indicator continues to flash between red and green and: ■ the fan doesn't turn on, then the problem is probably with the module processor pcb, pn 800210-00x; or ■ the fan does turn on, then the problem is in the data acquisition module. Try replacing the offending assembly.

Table 3-2. Troubleshooting Chart

Does the Tram Module communicate with the monitor or display? Yes No	If the Tram module is inserted in a monitor, try viewing the software revisions at the monitor. The Tram module software revision should be among the revisions listed. If it isn't, the Tram module isn't communicating with the monitor. When the Tram module doesn't communicate with a transport display, the transport display shows a COMMUNICATION FAILURE message. 1. If the Tram module communicates with a monitor, but not a transport display, ▪ make sure the Tram module is plugged into the connector at the rear of the transport display (it's not supposed to work in the one on the side of the transport display), ▪ if it's connected to the correct connector, suspect the non-isolated input PCB, pn 401315-002, or the flex circuit that connects it to the module processor PCB. Try testing continuity on the flex circuit or swapping the assemblies. ▪ if that doesn't work, try swapping the module processor PCB, pn 800210-00x. 2. If the Tram module communicates with a transport display, but not a monitor: ▪ first, try replacing the power supply PCB, pn 401309-002, then, ▪ try swapping the module processor PCB, pn 800210-00x, with a known-good one. 3. If the Tram module doesn't communicate with either the transport display or the monitor, suspect the module processor PCB, pn 800210-00x.
End	This is the extent of the troubleshooting steps developed at this time.

Service Messages

Service messages are usually located in the upper left corner of the screen on the transport display when they are active. The exception to this rule is “BATTERY FAIL”, which is located in the center of the screen on the transport display when it is active.

The following is a list of the possible service messages that can be encountered when using a transport display with one of the Tram modules, and what they mean.

Table 3-3. List of Service Messages

Message	Description
CALL SERVICE 25	Bus error occurred.
CALL SERVICE XX	Task Stack Overflow Error. ■ If XX<25, then XX is the number of a Tram module task for the stack overflow. ■ If XX≥50, then XX-49 is the number of a transport display task for the stack overflow.
CALL SERVICE 201	68000 microprocessor diagnostics failure.
CALL SERVICE 202	Tram module ROM checksum error during start-up.
CALL SERVICE 203	Tram module ROM checksum error during operation.
CALL SERVICE 204	Tram module RAM read/write test failure after hot start.
CALL SERVICE 205	Tram module RAM read/write test failure after cold start.
CALL SERVICE 206	Tram module RAM read/write test failure during operation.
CALL SERVICE 208	Tram module RAM battery voltage low. Replace battery BT1 on the module processor PCB, pn 800210-00x.
EVALUATION ONLY	Tram module software is an unreleased version.
LOW BATTERY	Battery capacity is under 20%.
BATTERY POWERED	The Tram module is running on battery power.
BATTERY FAIL	Smart-pac battery pack failure. This error is usually caused by one of these conditions: ■ Battery pack cell reversal detected ■ Battery pack cell over-temperature detected during charging ■ Battery pack voltage is less than 10 volts ■ Smart-pac battery backpack lost communication with batteries. ■ Try charging the Smart-pac battery pack in a Smart-pac charger.

Theory of Operation

Overall Theory

Overall theory of operation is described in the following paragraphs. Detailed theory of operation for the module processor PCB is described last.

Refer to the top level block diagram and interconnect signals in the top level assembly chapters presented later in this manual for the specific promontories described below represented in your Tram module.

DAS Module

Each Tram module contains a DAS (data acquisition) module that collects patient data for those parameters that require their electrodes, transducers, and sensors to be isolated from ground for the safety of the patient. These parameters include ECG, pressure, and temperature or cardiac output. The DAS module sends the patient data to the module processor PCB and any other devices on the Tram-net network that require real-time patient data. The DAS module also includes some of the NPB plumbing.

The DAS module contains two circuit boards:

- the isolated power supply PCB, pn 402329 (see Chapter 25), and
- the acquisition processor PCB, pn 800330/801040 (see Chapter 29).

Acquisition Processor PCB

The acquisition processor PCB performs the data acquisition functions for the isolated inputs of the Tram module. This includes:

- conditioning all ECG, invasive blood pressure, temperature, and cardiac output signals from electrodes, transducers, sensors, and probes on the patient,
- converting those signals from analog signals to digital data, and
- sending the digital data across the Tram-net to the module processor PCB for further processing.

Isolated Power Supply PCB

The isolated power supply PCB is located in the DAS module provides the acquisition processor PCB, pn 800330/801040, with power. Since the acquisition processor PCB has several direct connections with patient electrodes, transducers, etc., the power that it uses must be isolated from ground to protect the patient from potentially hazardous current leakage during defibrillation and electrosurgery. As a result, every voltage produced by this PCB is isolated from earth ground.

Power Supply PCB

The power supply PCB performs all power conversions in the Tram and supplies all of the other PCBs with the correct voltage levels. The exception to this is the acquisition processor PCB, which is powered by the isolated power supply PCB. The power supply PCB also serves as a path for signals between the module processor PCB, pn 800210, and the monitor.

Non-Isolated Input PCB

The non-isolated input PCB is a passive circuit board that passes signals between the module processor PCB, pn 800210, and the connectors for the transport display and analog output.

Power Indicator PCB

The power indicator PCB, pn 403170-009, is a passive circuit board that illuminates the power LED. The power indicator PCB, pn 403170-011, also passes signals between the pulse oximetry PCB and the SpO2 probe connector on the front panel of the Tram module.

PN 403170-009 is used in the Tram 100A/500A modules.

PN 403170-011 is used in the Tram 250SL, 450SL, 650SL, and 850A/SL modules.

Both the power indicator PCB, pn 403170-008, and the interconnect PCB, pn 800006-001, are used in the Tram 200A/SL, 400A/SL, 600A/SL, and 800A/SL modules. The interconnect PCB is a passive circuit board that simply passes signals between the Ohmeda pulse oximetry PCB and the power indicator PCB.

Fan PCB

The fan PCB regulates the power going to the fan. It also serves as a signal path between the module processor PCB and the NBP valve assembly.

NBP Valve Assembly

The NBP valve assembly is used in the Tram 100A, 200A/SL, 250SL,400A/SL, 450SL, 800A/SL, and 850A/SL modules. The NBP valve assembly contains the pressure release valves that regulates the air pressure in the non-invasive blood pressure cuff.

PN 413021-001 replaced pn 404459-001 in most Tram assemblies.

NBP PCB

This PCB interfaces the pump and solenoid valves in the noninvasive blood pressure assembly with the module processor PCB. This includes buffering pump and solenoid control signals from the module processor PCB, and returning NBP status information to the module processor PCB. Note that all signals between the NBP PCB and the module processor PCB travel across the fan PCB.

Pulse Oximetry PCB

The pulse oximetry PCB acquires arterial oxygen saturation and peripheral pulse rate data using the SpO_2 probe.

For Tram 250, 450, 650, and 850 modules, circuit board, pn 800674-001, supports MEI and Nellcor SpO_2 probes and is produced by Marquette Electronics, Inc. The encasing housing assembly for the circuit board is pn 414409-001.

For Tram 200, 400, 600, and 800 modules, circuit board, pn 41189-001, supports Ohmeda probes and is produced by Ohmeda. Ohmeda supports this PCB with an *Ohmeda MINX Module Interface Manual.* The manual includes schematic diagrams, theory of operation, and troubleshooting to the component level.

For service information about the Ohmeda circuit board, the manual, pn 1128-304, is only available directly from the following address.

Ohmeda
1315 West Century Drive
Louisville, CO 80027
Phone:(303) 666-7001
(800) 652-2469
Fax:(303) 665-9231
Telex:296 445 BTI UR

For more details about the interconnect PCB between the Ohmeda circuit board and the power indicator circuit board, refer to chapter 25.

Module Processor PCB

Versions

There are three different versions of the module processor PCB:

- PN 800210-001 was used first in all of the A-series modules; and
- PN 800210-002 was introduced in the SL-series modules, and then added to the A-series modules; and
- PN 800210-005 replaced both of the first two versions.

NOTE
You may replace either version -001 or -002 board with a -005 board, but do not replace a -005 with a -001 or -002 circuit board.

Overview

The module processor PCB performs most of the data processing in the Tram module. It contains two microprocessors and the support hardware necessary to run them. It collects patient data from the acquisition processor and pulse oximetry pcb assemblies, processes that data, and formats the data for a Series 70XX monitor, Tramscope monitor, Solar monitor, or a transport display. The data then passes through the power supply PCB, pn 401309, on its way to a monitor, or through the non-isolated input PCB, pn 401315, on its way to a transport display.

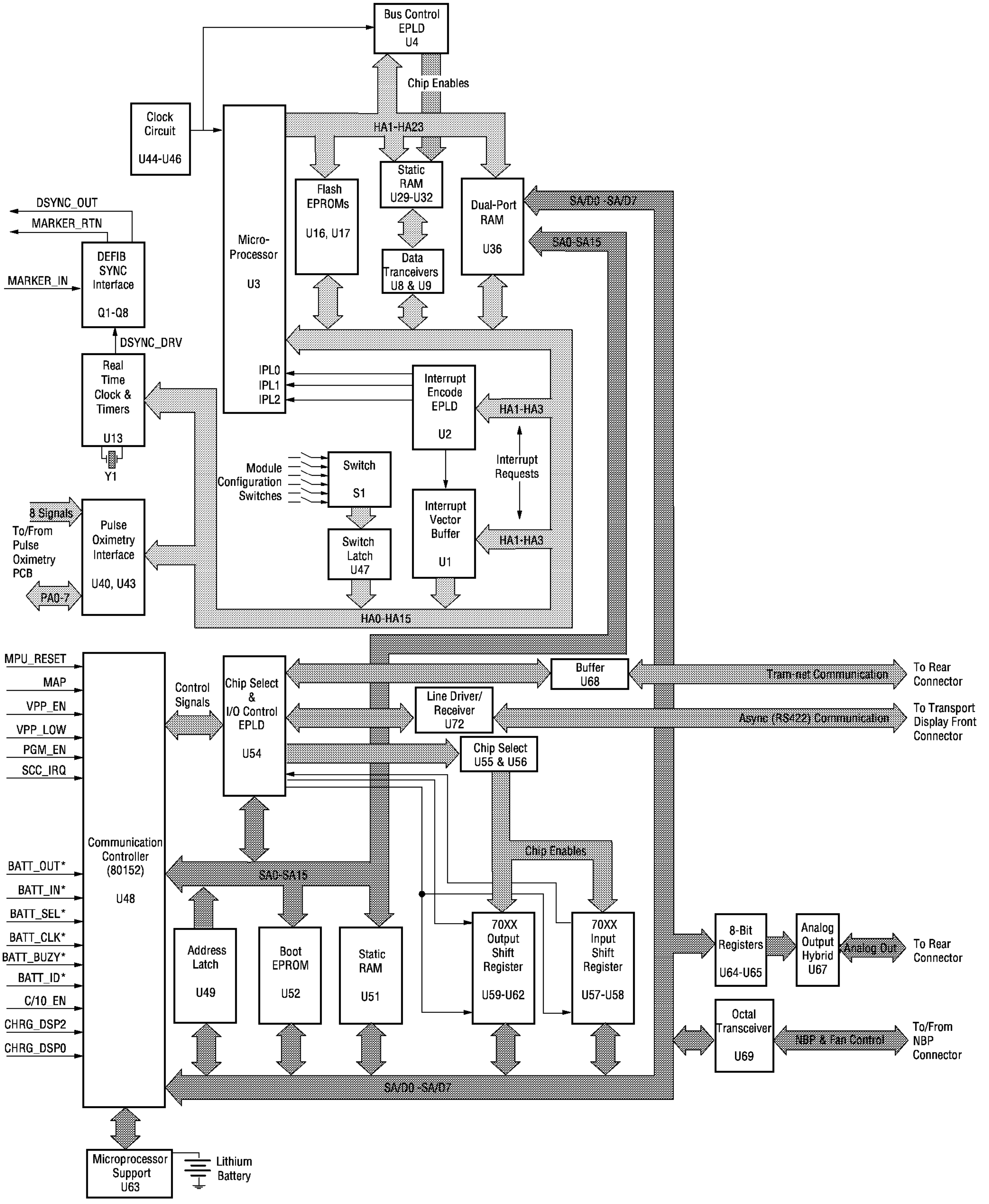
The module processor PCB is a dual processor design consisting of a main microprocessor U3 and communication controller U48. Both processors operate at a frequency of 14.7456-MHz. The dual processor approach frees the main microprocessor from performing low level tasks such as A/D converter control and UART servicing, allowing the available main microprocessor time to be used for digital filtering, arrhythmia analysis, and other algorithmic processing. Communications, analog outputs, and most other I/O tasks are handled by the communication controller. Patient waveform data is acquired by the acquisition processor PCB which contains its' own processor.

Operating code for the TRAM module is stored in electrically erasable flash EPROM memory U16 and U17 and downloaded at each power- up from the main microprocessor to the other processors in the module. Code may be updated electrically via communication with a PC directly to the front connector.

Main Microprocessor

The main microprocessor U3 functions as the host CPU. It controls and coordinates the activities of the other processors in the module. The main microprocessor accesses fairly large amounts of program and data storage memory (for an embedded system). On power up, it downloads operating code to both the communication controller and the acquisition processor on the acquisition processor PCB via an internal synchronous serial link. Communication with the communication controller is handled by dual-port RAM U36 which provides asynchronous access to the shared static RAM array U29-U32, except for the case in which both processors attempt to access the same address and one is performing a write operation.

Given below is the overall block diagram for the module processor PCB. Details are discussed in the following paragraphs.


Bus Control EPLD U4
Chip Enables
Clock Circuit U44-U46
Micro-Processor U3
IPL0
IPL1
IPL2
HA1-HA23
Flash EPROMs U16, U17
Static RAM U29-U32
Data Tranceivers U8 & U9
Dual-Port RAM U36
SA/D0 -SA/D7
SA0-SA15
DSYNC_OUT
MARKER_RTN
MARKER_IN
DEFIB SYNC Interface Q1-Q8
DSYNC_DRV
Real Time Clock & Timers U13
Y1
Interrupt Encode EPLD U2
HA1-HA3
Interrupt Requests
Module Configuration Switches
Switch S1
Switch Latch U47
Interrupt Vector Buffer U1
HA1-HA3
8 Signals
To/From Pulse Oximetry PCB
PA0-7
Pulse Oximetry Interface U40, U43
HA0-HA15
MPU_RESET
MAP
VPP_EN
VPP_LOW
PGM_EN
SCC_IRQ
Control Signals
Chip Select & I/O Control EPLD U54
Buffer U68
Tram-net Communication
To Rear Connector
Line Driver/ Receiver U72
Async (RS422) Communication
To Transport Display Front Connector
Chip Select U55 & U56
Chip Enables
Communication Controller (80152) U48
BATT_OUT*
BATT_IN*
BATT_SEL*
BATT_CLK*
BATT_BUZY*
BATT_ID*
C/10_EN
CHRG_DSP2
CHRG_DSP0
SA0-SA15
Address Latch U49
Boot EPROM U52
Static RAM U51
70XX Output Shift Register U59-U62
70XX Input Shift Register U57-U58
8-Bit Registers U64-U65
Analog Output Hybrid U67
Analog Out
To Rear Connector
Octal Transceiver U69
NBP & Fan Control
To/From NBP Connector
SA/D0 -SA/D7
Microprocessor Support U63
Lithium Battery

The following is a summary of the main microprocessor U3 hardware features:

- It operates at 14.7456-MHz and an external clock applied via pin 15. All logic requiring a synchronized clock is driven by the external clock source.
- 512K bytes of flash program memory U16-U17 (1 wait state) is electrically bulk erased and reprogrammed in system. 150nS access time parts operate at 1 wait state.
- 512K bytes CMOS battery-backed static (1 wait state). The entire static RAM array U29-U32 are continuously powered by a 3V 1AH lithium cell. 120 or 150nS chips run at 1 wait state.
- 8K bytes of dual port RAM U36 (zero wait state), is provided for high speed inter-processor communications.
- An interrupt encoder EPLD U2 is used as a dedicated five external interrupt handler. Three of the interrupts are edge-triggered types which are sampled and edge-detected by the EPLD. An 8-bit interrupt vector is output on the lower data bus by a decoder buffer U1 during a zero wait state IACK cycle (I acknowledge).
- Asynchronous bus control using EPLD U4 provides bus control logic for the main microprocessor. It generates chip selects, DTACK, and BUS ERROR signals using a buried or internal bus state counter. Chip selects are generated by decoding address lines A12 - A23.
- Battery-backed real-time-clock U13 provides time and date functions along with two general purpose multi-mode timers. The clock source for the timers is software selectable up to a maximum of 7.3728-MHz. The real-time-clock runs at 32.768-KHz using an on chip oscillator with external crystal Y1. A trim capacitor C2 provides the frequency fine-tuning required for accurate time keeping.
- The pulse oximetry function is implemented by a microprocessor based board either built by MEI or sourced by OHMEDA, called the MINX. It interfaces to the main microprocessor via one 8-bit input port, one 8-bit bidirectional port, and a number of handshake and control signals. In addition, the MINX generates two interrupts to the main microprocessor. The I/O ports appear as standard memory mapped devices with the handshake lines generated by hardware as the read and write cycles are run by the main microprocessor.

A 8-bit communication controller U48 functions as the serial communications and I/O processor. The communication controller retains the instruction set and on-chip peripherals timer/counters, UART, I/O ports, etc. In addition, it features a multi-protocol communication controller called the “Global Serial Channel,” two channels of DMA, and three more general purpose I/O ports (for a total of six ports).

Communication Controller

Upon system power-up, the communication controller executes code stored in a 8K x 8 boot EPROM U52. Unlike the flash memory used for the main microprocessor, the boot code is permanent and may not be updated electrically. Initially the communication controller holds the main microprocessor in reset. When ready, it will allow the main microprocessor to come out of reset and the two will establish communications via the dual-port RAM U36. The main microprocessor then downloads operating code which the communication controller stores in static RAM U51 for execution. The normally separate program and data memory areas of the communication controller are combined into one block of 64K in static RAM U51, allowing the communication controller to execute code out of RAM.

The following is a summary of the I/O and system related functions handled by the communication controller U48:

- Controls enable signals for all other systems in the Tram. The idea here is to have one processor coordinate and control the status of the many subsystems in the Tram module. These include the main microprocessor reset, the acquisition power (and hence the acquisition processor reset), the MINX pulse oximetry board, the cooling fan, the NIBP module, and the flash memory programming controls. The hardware watchdog timer must also be serviced by the communication controller. Should the watchdog time-out, the microprocessor will be reset and the subsystems will be disabled.
- Implements the multi-protocol backplane digital interface. The Tram supports three different backplane interfaces including the 7010 synchronous shift register interface, asynchronous communications at 38.4K baud, and Tram-net synchronous network communications at 921.6K baud.
- Provides asynchronous communications with the TRAM LCD display at 38.4K baud via the front panel DISPLAY PORT. The communication controller contains an on-chip single channel UART which must be switched between the display port and the backplane.

NOTE
While the Tram supports asynchronous communications to both the display and the backplane, it cannot do so simultaneously. When used with low-end async-only Tramscope monitors, the Tram module cannot provide uninterrupted monitoring capability.

- Communicates with the data acquisition module synchronously at 921.6K baud either internally or over Tram-net communication. With Tram-net systems the acquisition data is actually sent onto the network and received back by the communication controller.

- The analog output hybrid U67 provides eight channels of analog output written to a 16-bit data/control port at a rate of 480-Hz. An internal DAC converts the port data to an analog voltage which is stored on a "hold" capacitor, buffered, and output.
- The Tram contains a small, low-noise cooling fan which is switched on as needed based on temperature information received from the acquisition processor. In the 7010 bedside monitor system, the fan will typically run continuously. In new Tram-rac systems, additional cooling should not be needed and the fan will remain off. Running the fan on an "as needed" basis minimizes the amount of dust, lint, etc. introduced into the module.
- The NBP module interface provides an 8-bit bidirectional port, two register select lines (buffered address lines), independent read and write strobes, an I/O chip select signal, and a master enable.
- The Tram module supports three different communications interfaces to/from its' backplane connector to make it compatible with both existing Series 70XX-type monitors and Tram Critical Care systems. These include the following:
  - Series 70XX synchronous shift register interface
  - Tram-net synchronous communication at 921.6K baud
  - Asynchronous communication at 38.4K baud

Block diagrams for each are presented on the next page. Tram-net systems require a carrier detect signal which is driven low as long as data transmissions are detected on the network. Carrier detect is driven high 1-1/2 bit times after the last edge is detected. In addition, if the acquisition processor and the communication controller were to transmit Tram-net data simultaneously (i.e. collide, as indicated by an overlap of each processors' driver enable signal), a special 'collision presence' waveform must be output to allow all network users to detect the collision. Buried logic on the chip select EPLD U56 handles these functions.

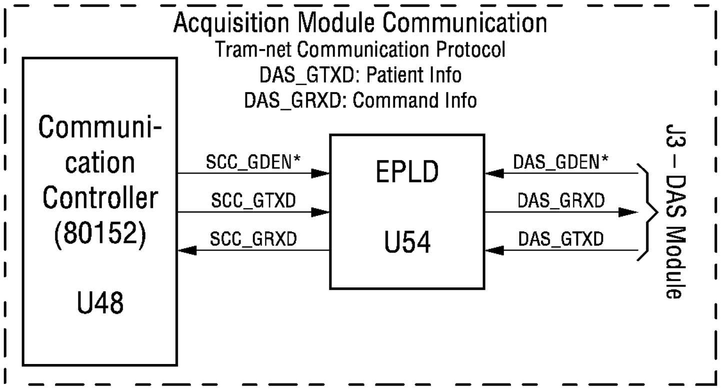
Memory and I/O device chip selects are also generated by the chip select EPLD. The fifteen device chip selects are output as four encoded chip selects (ECS0, ECS1, ECS2, and ECS3) which are expanded externally by a decoder chip select device U55.

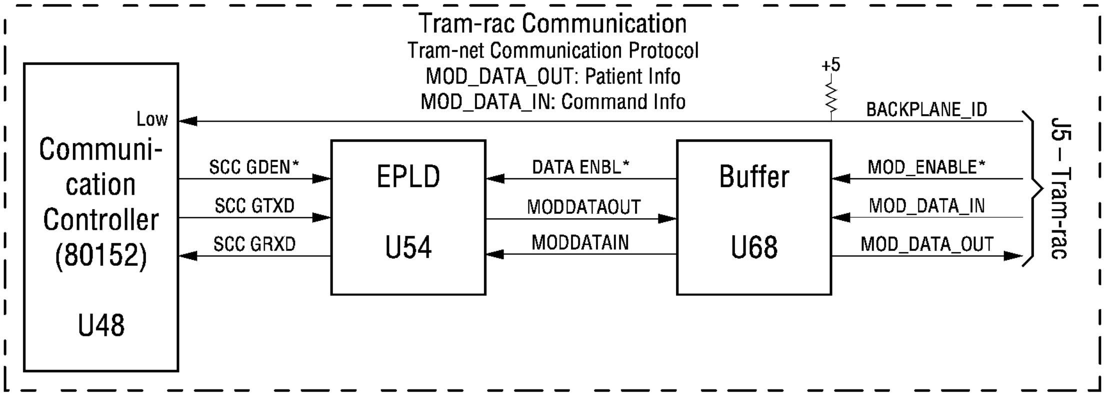
DEFIB SYNC Interface

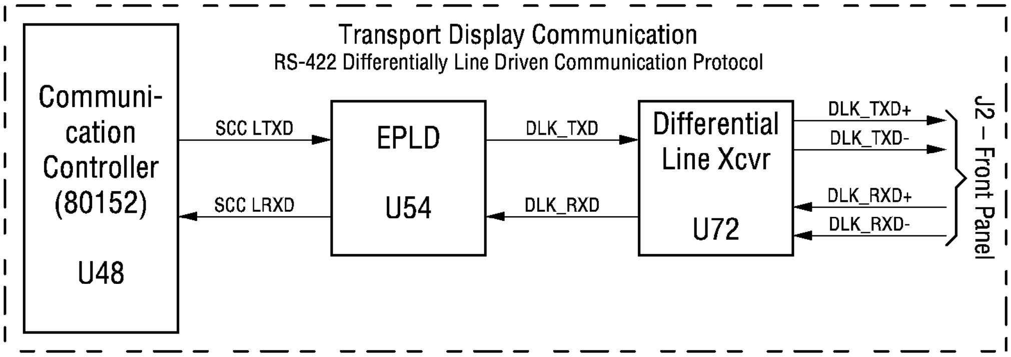
The DEFIB SYNC interface will detect QRS and output trigger pulse on pin 3 of the 6-pin circular connector labeled DEFIB SYNC. A Marquette defibrillator will return the same pulse on pin 4 if it is powered up and SYNC MODE is selected. The monitor then displays a marker pulse on the screen. Both signals are referenced to pin 2 (DGND). The defibrillator will fire when the SHOCK key(s) are pressed and the sync pulse arrives at the TRIGGER IN input.

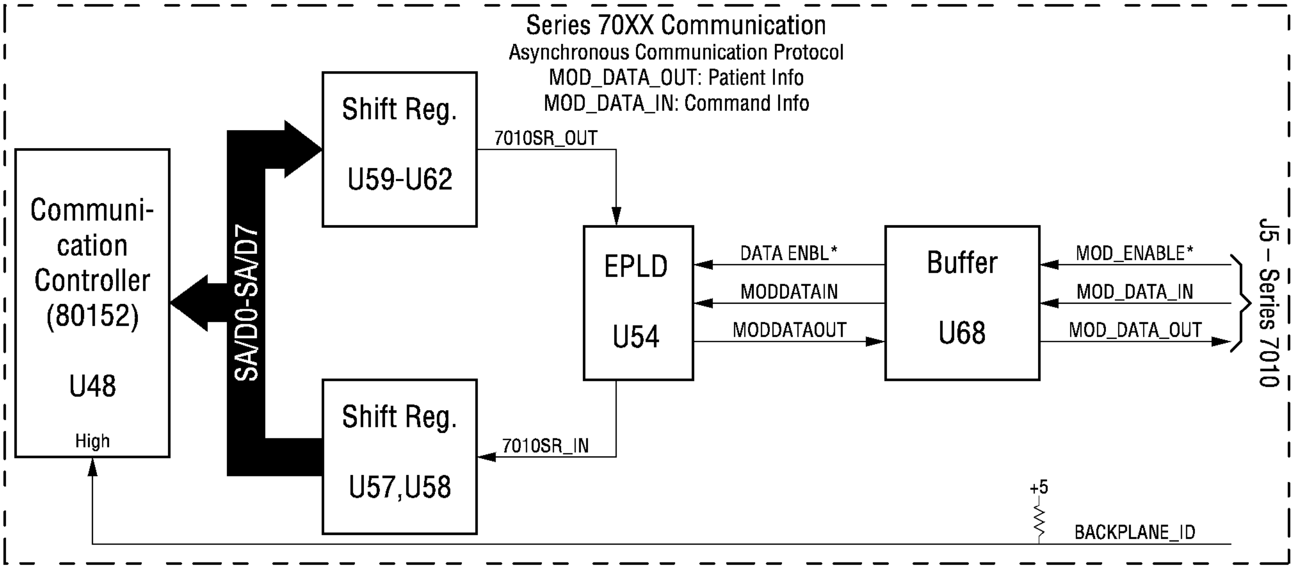
SYNC MODE can be selected on the defibrillator only if it is connected to the Tram module and both units are powered up. The Tram SYNC OUT is open circuit when not powered to allow the defibrillator to detect the power OFF condition.

The following block diagrams represent the different types of communication provided by the module processor PCB.


Acquisition Module Communication
Tram-net Communication Protocol
DAS_GTXD: Patient Info
DAS_GRXD: Command Info
Communi-cation Controller (80152)
U48
SCC_GDEN*
SCC_GTXD
SCC_GRXD
EPLD
U54
DAS_GDEN*
DAS_GRXD
DAS_GTXD
J3 – DAS Module


Tram-rac Communication
Tram-net Communication Protocol
MOD_DATA_OUT: Patient Info
MOD_DATA_IN: Command Info
Communi-cation Controller (80152)
U48
Low
+5
BACKPLANE_ID
SCC GDEN*
SCC GTXD
SCC GRXD
EPLD
U54
DATA ENBL*
MODDATAOUT
MODDATAIN
Buffer
U68
MOD_ENABLE*
MOD_DATA_IN
MOD_DATA_OUT
J5 – Tram-rac


Transport Display Communication
RS-422 Differentially Line Driven Communication Protocol
Communi-cation Controller (80152)
U48
SCC LTXD
SCC LRXD
EPLD
U54
DLK_TXD
DLK_RXD
Differential Line Xcvr
U72
DLK_TXD+
DLK_TXD-
DLK_RXD+
DLK_RXD-
J2 – Front Panel


Series 70XX Communication
Asynchronous Communication Protocol
MOD_DATA_OUT: Patient Info
MOD_DATA_IN: Command Info
Communi-cation Controller (80152)
U48
High
SA/D0-SA/D7
Shift Reg.
U59-U62
7010SR_OUT
Shift Reg.
U57,U58
7010SR_IN
EPLD
U54
DATA ENBL*
MODDATAIN
MODDATAOUT
Buffer
U68
MOD_ENABLE*
MOD_DATA_IN
MOD_DATA_OUT
+5
BACKPLANE_ID
J5 – Series 7010

4 CALIBRATION

Adjustments, Jumpers, and Switches 4-2

Power Supply PN 401309 4-3
Clock Frequency Calibration 4-3

Isolated Power Supply PCB PN 402329 4-4
+5-Volt Isolated Output Calibration 4-4

Module Processor PCB PN 800210 4-5
Switches and Jumpers 4-5
Switches for Versions 001/002 4-6
Switches for Versions 005 Only 4-7
Real-Time Clock Calibration 4-8
Battery Low Voltage Trip-Point Calibration 4-9

Acquisition Processor PCB PN 800330 4-10
Analog-to-Digital Converter Calibration 4-10

Acquisition Processor PCB PN 801040 4-11
Analog-to-Digital Converter Calibration 4-11

NBP Calibration 4-12
Accuracy 4-12
Frequency 4-12
Special Equipment/Tools 4-12
Preparation 4-13
Two Procedures 4-13
    NBP Test for Tram Critical Care Monitors 4-15
    NBP Test for Series 70XX Monitor 4-21

Software Update Procedure 4-22
Required Special Tools/Equipment 4-22
Interconnection 4-22
PC Setup 4-23
Generic Procedure 4-23
Completion 4-25

Adjustments, Jumpers, and Switches

The following list summarizes Tram module's switches, jumpers, and adjustments. The following pages contain procedures, in much greater detail, for setting these items.

NOTE
Before starting any calibration procedure, refer to the "Considerations for Special Components," listed in Chapter 3: "Troubleshooting." This PCB uses many CMOS components, and when exposed to outside influences is highly susceptible to ESD damage.

Power Supply PCB, pn 401309

R14	Power supply clock frequency adjustment

Isolated Power Supply PCB, pn 402329

R1	+5 ISO voltage adjustment

Module Processor PCB, pn 800210

W1	Defib sync level jumper
W2	Defib sync duration jumper
W3	Battery disconnect jumper
S1	Various software and hardware configuration switches
C2	Real-time clock frequency adjustment
R64	Battery low voltage trip point adjustment

Acquisition Processor PCB, pn 800330

R16	Analog-to-digital converter offset adjustment
R17	Analog-to-digital converter gain adjustment

Acquisition Processor PCB, pn 801040

R35	Analog-to-digital converter offset adjustment
R37	Analog-to-digital converter gain adjustment

This chapter also includes non-invasive blood pressure (NBP) calibration procedures. These calibration procedures are performed through software, and do not require manual adjustments.

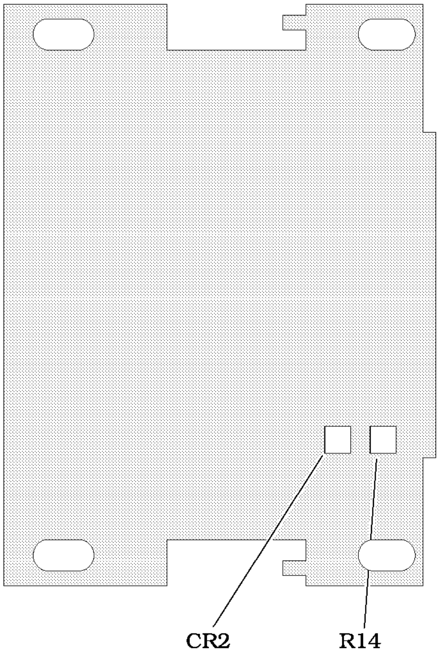
Power Supply PN 401309

Clock Frequency Calibration

The following procedure sets the frequency of the clock oscillator for the power supply. This procedure is only necessary when the power supply PCB has been repaired or replaced.

Before starting this procedure, refer to the “Considerations for Special Components,” listed in Chapter 3: “Troubleshooting.” This PCB is made almost entirely of CMOS components, and, when exposed to outside influences, is highly susceptible to ESD damage.

1. Expose the power supply PCB by removing the outside covers, shielding plates, etc. from the Tram module. Exploded views shown in chapters 7 through 16 will show the location of the circuit board, as well as the obstructions to the circuit board. You’ll have to remove the four screws that secure the power supply PCB to the frame to access the adjustments.
2. Apply power to the Tram module. The easiest way to do this is to connect a Smart-pac Transport display to the front panel connector of the Tram module.
3. The pulse width modulator must be warmed up before continuing with the procedure. Wait at least two minutes before going to the next step.
4. Connect a frequency counter across diode CR2.
5. Adjust variable resistor R14 until the frequency counter reads 95.0 kHz (±1.0 kHz).



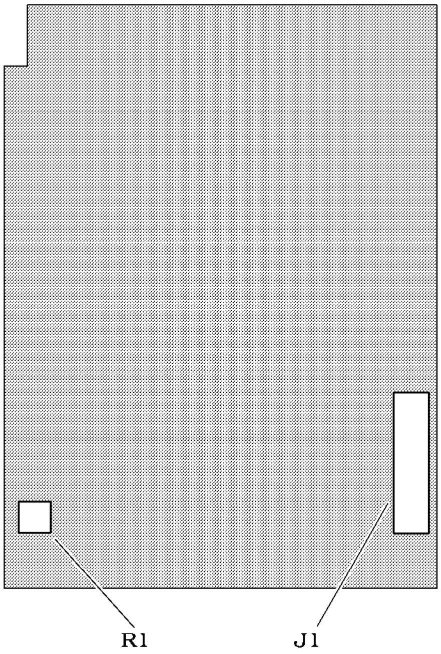
6. Seal the end of variable resistor R14 to prevent it from moving.
7. Remove power from the Tram module.
8. Reassemble the Tram module.

Isolated Power Supply PCB PN 402329

+5-Volt Isolated Output Calibration

The following procedure accurately sets the +5-volt isolated power output of the isolated power supply PCB. This procedure is only necessary when the isolated power supply PCB has been repaired or replaced.

Before starting this procedure, refer to the “Considerations for Special Components,” listed in Chapter 3: “Troubleshooting.” This PCB use many CMOS components, and, when exposed to outside influences is highly susceptible to ESD damage.



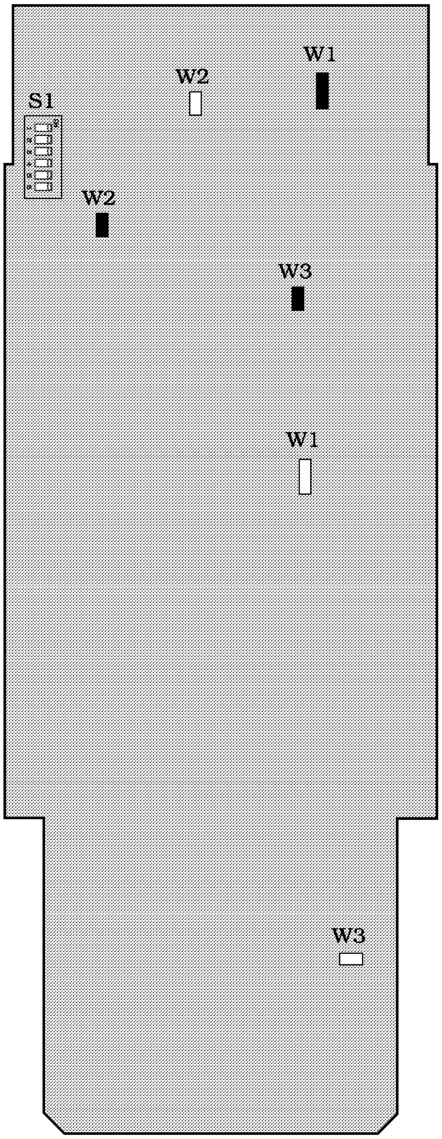
You’ll need an extender cable so you can access the adjustments. To make the extender cable, you need two 2 x 8, 0.010-inch center connectors, pn 1783-016. You also need a pc header, pn 1778-916, and some wire. Wire the extender cable so that each pin on one connector is directly wired to the same pin on the other connector.

1. Expose the data acquisition module by removing the outside covers, shielding plates, etc. from the Tram module. Exploded views shown in chapters 7 through 16 will show the location of this assembly, as well as the obstructions to the assembly.
2. Remove the top cover of the data acquisition module to reveal the isolated power supply PCB.
3. Pull up on the power supply PCB to disconnect it from the acquisition PCB.
4. Connect the extender cable between connector J1 on the acquisition PCB and connector J1 on the isolated power supply PCB.
5. Apply power to the Tram module. The easiest way to do this is to connect a Smart-pac Transport display to the front panel connector of the Tram module.
6. Connect a volt meter across pins 6(–) and 7(+) of connector J1.
7. Adjust variable resistor R1 until the volt meter reads 5.00 V (±0.01 V).
8. Seal the end of variable resistor R1 to prevent it from moving.
9. Remove power from the Tram module.
10. Reassemble the Tram module.
11. Perform the current leakage and hi-pot tests listed in Chapter 5: “Preventive Maintenance.”

Module Processor PCB PN 800210

Switches and Jumpers

This page and the next describe the functions of the switches and jumpers on the module processor PCB, pn 800210.



▮ Indicates position for PN 800210-005

▯ Indicates position for PN 800210-001/2

NOTE
The position of the jumpers depends on the version of the circuit board.

There are three jumpers on this circuit board as follows:

W1 This jumper controls the output level of the defib sync pulse through the front panel connector. This jumper can be placed in one of two positions:

5V install a jumper in this location if the defibrillator used with the Tram module needs a 5-volt pulse, or

15V install a jumper in this location if the defibrillator used with the Tram module needs a 15-volt pulse.

This jumper is generally placed in the 5V position on new Tram modules.

W2 This jumper controls the pulse width of the defib sync pulse:

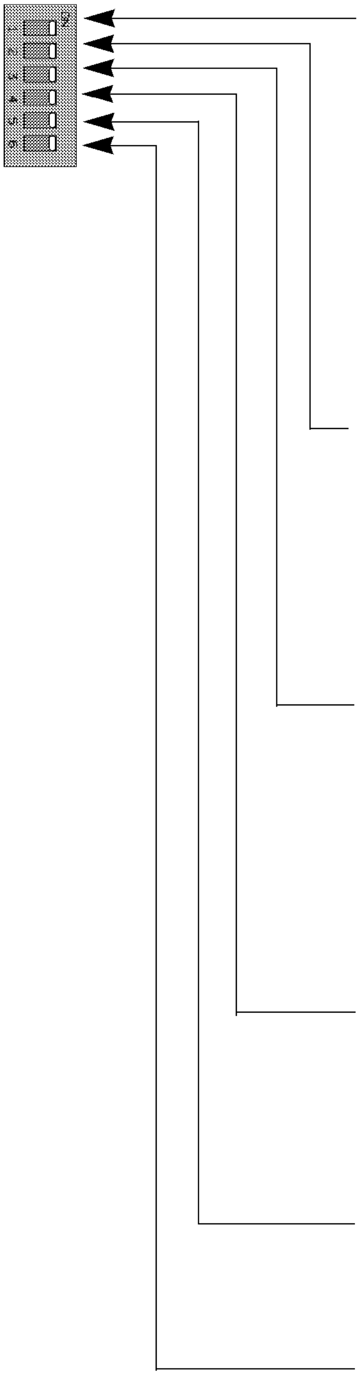
- install this jumper for a 100-millisecond pulse, or
- remove this jumper for a 10-millisecond pulse.

This jumper is generally not installed on new Tram modules.

W3 This jumper is provided to allow battery BT1 to be removed from the circuit for calibration and testing. Jumper W3 must be in place for proper operation.

Switches for Versions 001/002

Switch S1 is the only switch on the module processor PCB. This switch is a 6-station dip switch that is used to configure both hardware and software parameters. The following are the functions of each of the individual switch stations.



SW1 68000 Processor Clock Disable. The clock disable feature allows the 68000 microprocessor to be driven by an external clock source (typically an emulator) for development and service purposes. When the clock is disabled, an external clock must be applied to pin 15 of the 68000 microprocessor socket (U3). Note also that all logic on the module processor PCB that shares the clock signal with the 68000 microprocessor will also be driven by the external clock signal.

ON	68000 clock disabled
OFF	68000 microprocessor clock enabled

SW2 68000 Processor Clock Frequency. A half-speed clock may be selected for development and service testing where the test equipment (usually an emulator) is not capable of running at 14.7456 MHz, and an external clock is not available.

ON	Clock speed = 7.3728 MHz
OFF	Clock speed = 14.7456 MHz

SW3 Enables or inhibits software updates and NBP calibration on all Tram modules.

ON	Inhibit software updates and NBP calibration. During NBP calibration, when you select CAL GAIN from the menu, you'll be returned to the NBP CAL menu. You must turn this station off before proceeding.
OFF	Normal operation

SW4 Tram Integral Battery Option. The Tram 300 can be equipped with a Smaragdite battery pack. This switch enables that option.

ON	Tram 300
OFF	Tram 100, 200, 500, or 600

SW5 Unit System Select

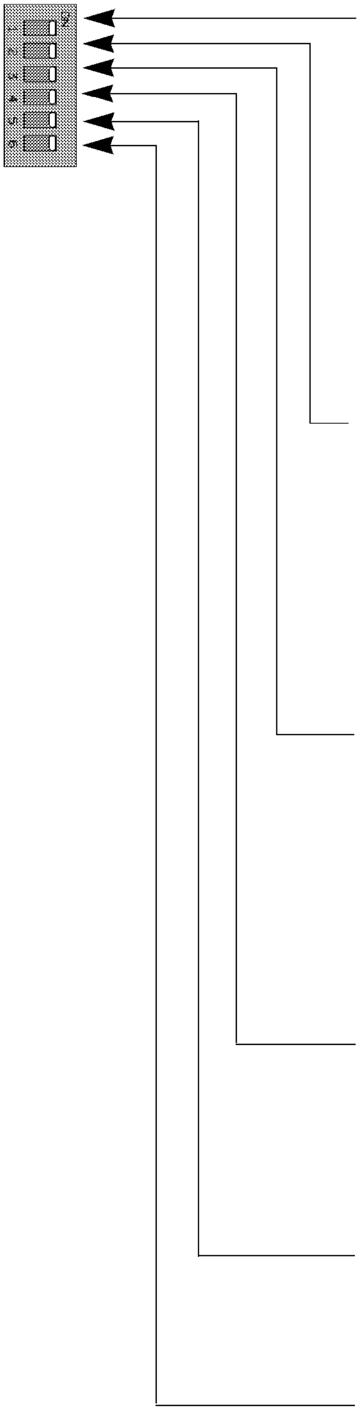
ON	English Units
OFF	SI Units

SW6 Power Frequency Select.

ON	50 Hz
OFF	60 Hz

Switches for Versions 005 Only

Switch S1 is the only switch on the module processor PCB. This switch is a 6-station dip switch that is used to configure both hardware and software parameters. The following are the functions of each of the individual switch stations.



SW1 Not Used

SW2 Not Used

SW3 Enables or inhibits software updates and NBP calibration on all Tram modules.

ON	Inhibit software updates and NBP calibration. During NBP calibration, when you select CAL GAIN from the menu, you'll be returned to the NBP CAL menu. You must turn this station off before proceeding.
OFF	Normal operation

SW4 Tram Integral Battery Option. The Tram 300 can be equipped with a Smartpac battery pack. This switch enables that option.

ON	Tram 300
OFF	Tram 100, 200, 500, or 600

SW5 Unit System Select

ON	English Units
OFF	SI Units

SW6 Power Frequency Select.

ON	50 Hz
OFF	60 Hz

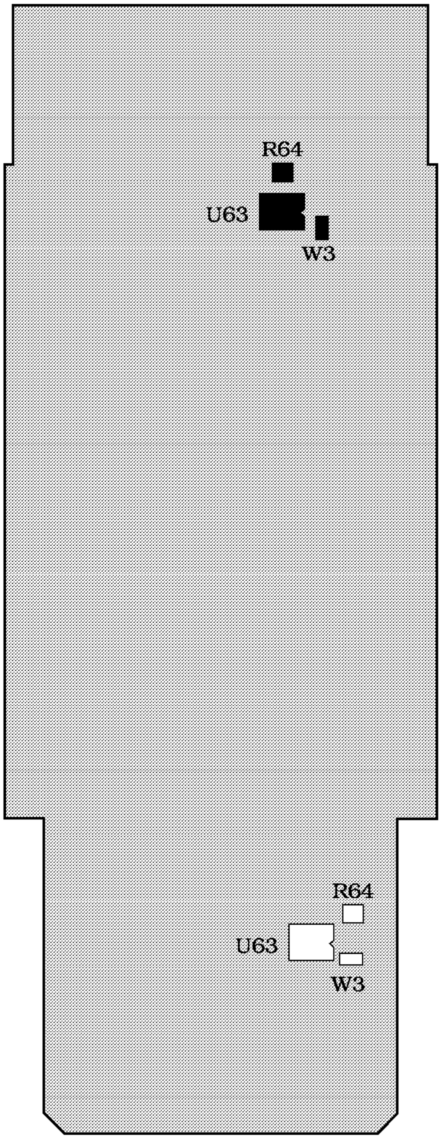
Real-Time Clock Calibration

The real-time clock on the module processor PCB may not be calibrated in the field. Therefore, if you replace any components in the real-time clock circuit, you should return the module processor PCB to Marquette Electronics, Inc. for calibration. The real-time clock circuit consists of capacitors C1 and C2, real-time clock U13, and oscillator Y1.

Battery Low Voltage Trip-Point Calibration

The module processor PCB contains battery-backed static RAM. The battery is a 3.0-volt battery, and is deemed too low to power the RAM when it has drained to the point where it only supplies 2.1 volts. This adjustment ensures that the Tram module will notify the transport display when the battery reaches the 2.1-volt level. The transport display then shows a service message on the display, CALL SERVICE 208, notifying the user that the battery should be changed.

This calibration should only be necessary when the module processor is removed and replaced.



▮ Indicates position for PN 800210-005

▯ Indicates position for PN 800210-001/2

NOTE
The position of the jumpers depends on the version of the circuit board.

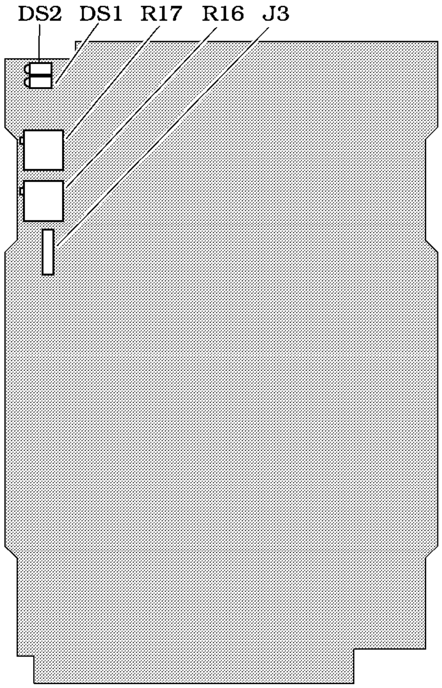
1. Remove jumper W3.
2. Turn variable resistor R64 fully clockwise. Some boards use a Murata Erie variable resistors for R64. These variable resistors have no positive mechanical stops, so you'll have to estimate full clockwise as best you can.
3. Apply an adjustable voltage source, set to 3.0 volts, to the W3 socket that is closest to the edge of the circuit board. The ground of the voltage source should be attached to a ground on the circuit board (pin 4 of U63 is a good one).
4. Verify pin 10 of U63 is a logic high.
5. Adjust the voltage source smoothly down to 2.1 volts. You must do this slowly and smoothly to avoid any undershoot.
6. Observe the logic level of pin 10 of U63 while slowly turning variable resistor R64 counter-clockwise. When the logic level of U63-10 goes low, stop turning.
7. Test this adjustment by ramping the power source from 3 volts to 2.1 volts again. Pin 10 of U63 should switch from a high to a low state at 2.1 volts ±50 millivolts.
8. Seal the end of variable resistor R64 to prevent it from moving.
9. Remove power from the Tram module.
10. Reassemble the Tram module.
11. Perform the Checkout Procedure, Current Leakage Tests, and Hi-Pot tests listed in Chapter 5: "Preventive Maintenance."

Acquisition Processor PCB PN 800330

Analog-to-Digital Converter Calibration

The following procedure accurately sets the zero offset and gain of the analog-to-digital converter on the acquisition processor PCB. This procedure is only necessary when the acquisition processor PCB has been repaired or replaced.

Before starting this procedure, refer to the "Considerations for Special Components," listed in Chapter 3: "Troubleshooting." This PCB uses many CMOS components, and when exposed to outside influences is highly susceptible to ESD damage.



1. Expose the data acquisition module by removing the outside covers, shielding plates, etc. from the Tram module. Exploded views shown in chapters 7 through 16 will show the location of this assembly, as well as the obstructions to the assembly.
2. Remove the top cover of the data acquisition module to reveal the acquisition processor PCB.
3. Apply power to the Tram module. The easiest way to do this is to connect a transport display with a battery pack to the front panel connector of the Tram module.
4. Jumper pins 2 and 3 of connector J3 together to enable the calibration mode. LEDs DS1 and DS2 will blink 5 times simultaneously to indicate the calibration mode is enabled.
5. Connect a low-noise, precision voltage source to the acquisition processor at pins 1 (+) and 4 (–) of connector J3. Set the voltage source to output –9.9976 volts.
6. If the offset adjustment of the analog-to-digital converter is inaccurate, either DS1 or DS2 will light.
   - If DS1 lights, rotate variable resistor R16 counter-clockwise until both lights are off.
   - If DS2 lights, rotate variable resistor R16 clockwise until both lights are off.

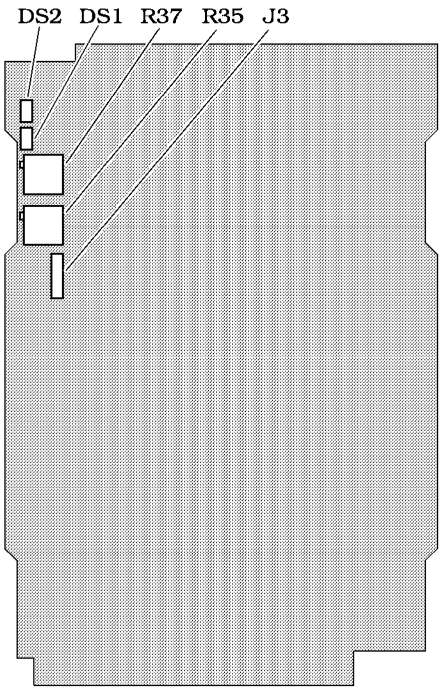
   Occasional blinking of the LEDs throughout the calibration procedure is normal. It doesn't necessarily mean that calibration is necessary again.
7. Adjust the voltage source to +9.9927 volts.
8. If the gain adjustment of the analog-to-digital converter is inaccurate, either DS1 or DS2 will light.
   - If DS1 lights, rotate variable resistor R17 counter-clockwise until both LEDs are off.
   - If DS2 lights, rotate variable resistor R17 clockwise until both LEDs are off.
9. Seal the end of variable resistors R16 and R17 to prevent them from moving.
10. Remove all power from the Tram module.
11. Remove the jumper from J3 and reassemble the Tram module.
12. Perform the Checkout Procedure, Current Leakage Tests, and Hi-Pot tests listed in Chapter 5: "Preventive Maintenance."

Acquisition Processor PCB PN 801040

Analog-to-Digital Converter Calibration

The following procedure accurately sets the zero offset and gain of the analog-to-digital converter on the acquisition processor PCB. This procedure is only necessary when the acquisition processor PCB has been repaired or replaced.

Before starting this procedure, refer to the Considerations for Special Components, listed in Chapter 3: Troubleshooting. This PCB uses many CMOS components, and when exposed to outside influences is highly susceptible to ESD damage.



1. Expose the data acquisition module by removing the outside covers, shielding plates, etc. from the Tram module. Exploded views shown in chapters 7 through 16 will show the location of this assembly, as well as the obstructions to the assembly.
2. Remove the top cover of the data acquisition module to reveal the acquisition processor PCB.
3. Apply power to the Tram module. The easiest way to do this is to connect a transport display with a battery pack to the front panel connector of the Tram module.
4. Jumper pins 2 and 3 of connector J3 together to enable the calibration mode. LEDs DS1 and DS2 will blink 5 times simultaneously to indicate the calibration mode is enabled.
5. Connect a low-noise, precision voltage source to the acquisition processor at pins 1 (+) and 4 (–) of connector J3. Set the voltage source to output –9.9976 volts.
6. If the offset adjustment of the analog-to-digital converter is inaccurate, either DS1 or DS2 will light.
   - If DS1 lights, rotate variable resistor R35 clockwise until both lights are off.
   - If DS2 lights, rotate variable resistor R35 counter-clockwise until both lights are off.

   Occasional blinking of the LEDs throughout the calibration procedure is normal. It doesn't necessarily mean that calibration is necessary again.
7. Adjust the voltage source to +9.9927 volts.
8. If the gain adjustment of the analog-to-digital converter is inaccurate, either DS1 or DS2 will light.
   - If DS1 lights, rotate variable resistor R37 clockwise until both LEDs are off.
   - If DS2 lights, rotate variable resistor R37 counter-clockwise until both LEDs are off.
9. Seal the end of variable resistors R35 and R37 to prevent them from moving.
10. Remove all power from the Tram module.
11. Remove the jumper from J3 and reassemble the Tram module.
12. Perform the Checkout Procedure, Current Leakage Tests, and Hi-Pot tests listed in Chapter 5: "Preventive Maintenance."

NBP Calibration

Accuracy

The accuracy of your non-invasive blood pressure (NBP) readings depends on the accuracy of two things:

- the zero pressure reading, and
- the voltage span of the NBP sensor in the module.

In this procedure you'll make sure that both of these items are accurate, and you'll check for NBP plumbing leaks at the same time.

Frequency

You should perform this procedure when:

- you first get your Tram module,
- before you use it on any patients,
- once every year, and
- each you open the module to make sure the pneumatic system has no air leaks.

Special Equipment/ Tools

You need a few items to perform this procedure.

- You need a Tram-compatible monitor, like a Tram Critical Care monitor (Tramscope or Solar display with Tram-rac housings) or a Series 70XX-type (7000, 7000RA, 7005, 7010, or 7010RA) monitor.
- You need an accurate manometer. A digital one, like the Sensym PDM200M is nice, but you can use a mercury manometer, too.
- You need an NBP tube:
  - If you have a Tram 100, 200, or 250 module, it is pn 9461-203.
  - If you have a Tram 400A module with an NBP connector that protrudes from the front of the module, you need pn 9461-208.
  - If you have a Tram 400A, 400SL, or 450SL module with a recessed NBP connector, or if you have a Tram 800A, 800SL, 850A, or 850SL module, you need pn 9461-212.
- You need an NBP cuff. Any size will do. If you don't have one, order pn 9461-301.
- You need something to wrap the cuff around. PVC pipe from your local hardware store works well.

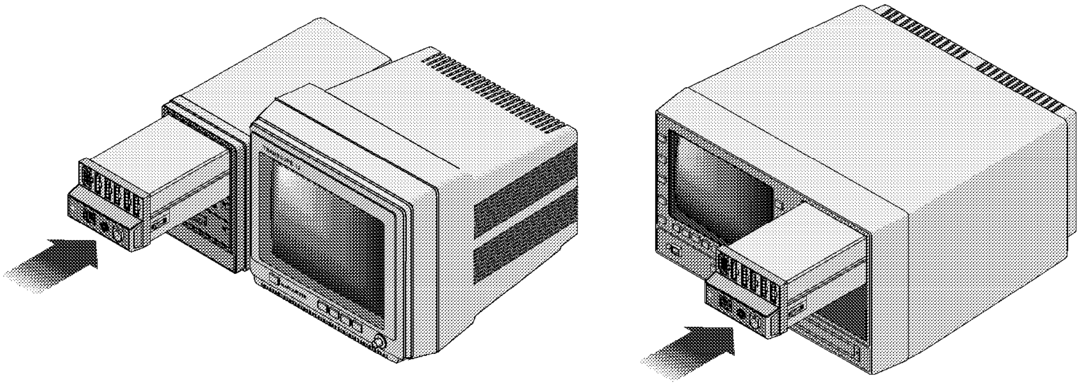
- You need these items to connect the NBP tube with the manometer and cuff.

Table 4-1. Description

Item	Part Number	Qty
NBP Cuff Coupling	MEI PN 400787-001	1
NBP Hose Coupling	MEI PN 46100-002	1
NBP Tee	MEI PN 4745-101	1
NBP Tubing	MEI PN 401582-001	2

Preparation

Insert the module in the top slot of a Tram-rac 4 housing or Series 70XX-type.



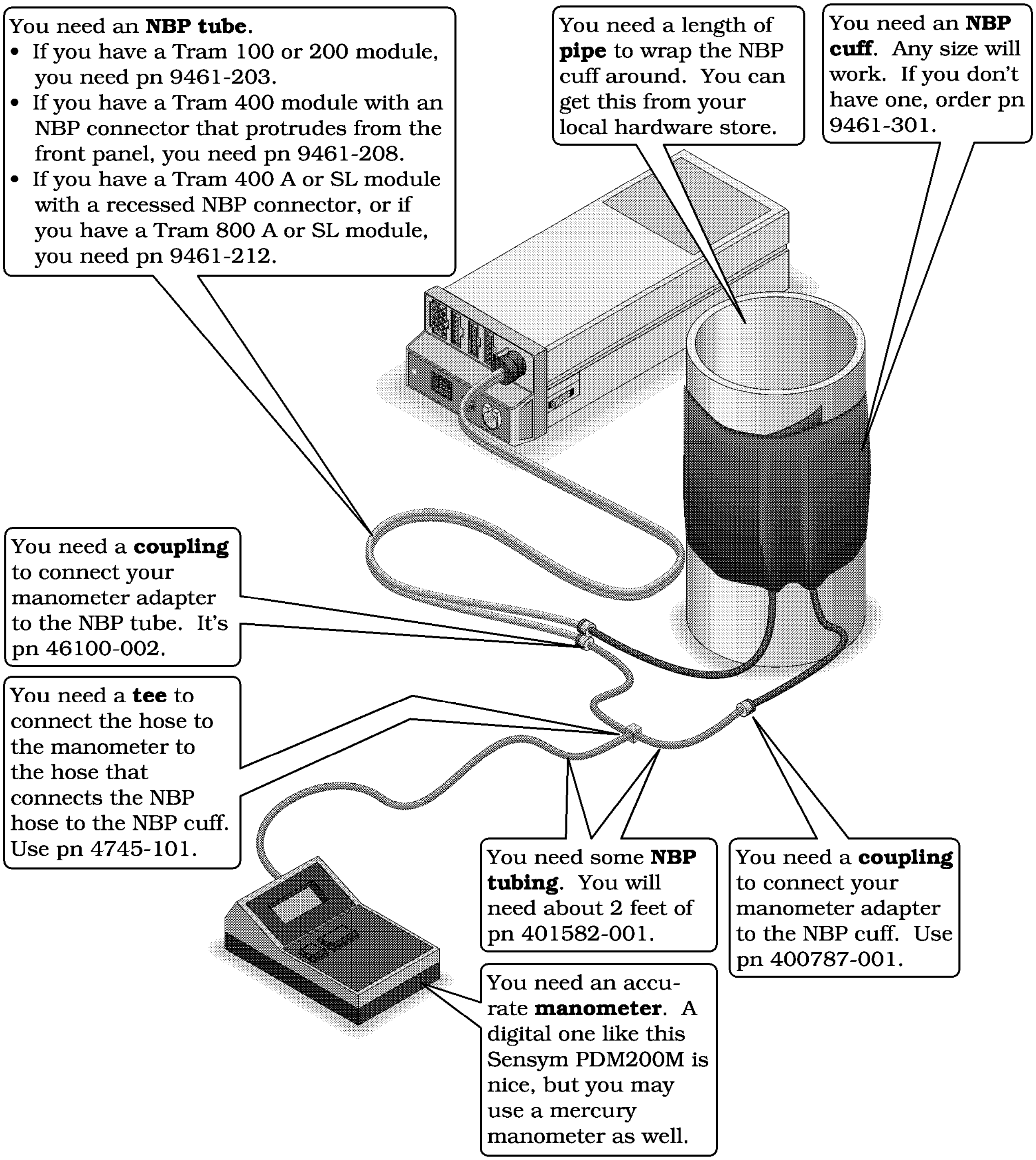
1. Disconnect all parameter cables
2. Apply power to the monitor. If your Tram-rac housing has its own power supply, apply power to it, too.
3. Enure POWER indicator on the Tram module's front panel is turned ON.

Two Procedures

There are two different NBP calibration procedures: one for Tram modules used with Tram Critical Care monitors (Tramscope or Solar display with Tram-rac housings), and one for Tram modules used with Series 70XX-type (7000, 7000RA, 7005, 7010, or 7010RA) monitors.

WARNING
When the NBP cuff is used in this procedure, it must be tightly wrapped around a tube. Never put the cuff around your arm during the calibration procedures. If you do put the cuff around your arm during this procedure, you will injure yourself.

1. Connect a manometer and NBP cuff to the NBP connector on the front of the Tram module as shown below.



You need an **NBP tube**.

- If you have a Tram 100 or 200 module, you need pn 9461-203.
- If you have a Tram 400 module with an NBP connector that protrudes from the front panel, you need pn 9461-208.
- If you have a Tram 400 A or SL module with a recessed NBP connector, or if you have a Tram 800 A or SL module, you need pn 9461-212.

You need a length of **pipe** to wrap the NBP cuff around. You can get this from your local hardware store.

You need an **NBP cuff**. Any size will work. If you don't have one, order pn 9461-301.

You need a **coupling** to connect your manometer adapter to the NBP tube. It's pn 46100-002.

You need a **tee** to connect the hose to the manometer to the hose that connects the NBP hose to the NBP cuff. Use pn 4745-101.

You need some **NBP tubing**. You will need about 2 feet of pn 401582-001.

You need a **coupling** to connect your manometer adapter to the NBP cuff. Use pn 400787-001.

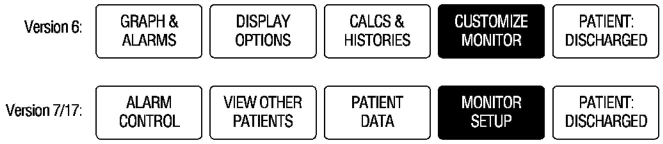
You need an accurate **manometer**. A digital one like this Sensym PDM200M is nice, but you may use a mercury manometer as well.

2. Turn the manometer ON, and set its range switch to the 1000 mmHg setting.
3. Select the appropriate procedure on the following pages.

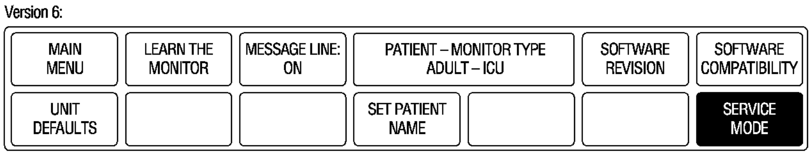
NBP Test for Tram Critical Care Monitors

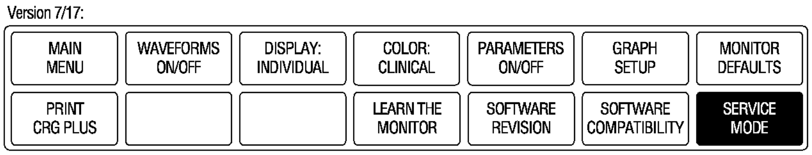
Perform this test if you are using the Tram module with a Tram Critical Care monitor (Tramscope or Solar monitor). This procedure assumes you have either version 6, 7, or 17 software in your Tramscope/Solar display, Tram-rac housing, and Tram module.

1. From the monitor's main menu, rotate the Trim Knob control to highlight CUSTOMIZE MONITOR (with version 6) or MONITOR SETUP (with version 7/17), and then press the Trim Knob control to select it.

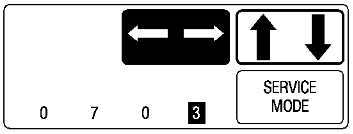

Version 6:
GRAPH & ALARMS
DISPLAY OPTIONS
CALCS & HISTORIES
CUSTOMIZE MONITOR
PATIENT: DISCHARGED
Version 7/17:
ALARM CONTROL
VIEW OTHER PATIENTS
PATIENT DATA
MONITOR SETUP
PATIENT: DISCHARGED

2. Rotate the Trim Knob control to highlight SERVICE MODE, and then press the Trim Knob control to select it.


Version 6:
MAIN MENU
LEARN THE MONITOR
MESSAGE LINE: ON
PATIENT – MONITOR TYPE ADULT – ICU
SOFTWARE REVISION
SOFTWARE COMPATIBILITY
UNIT DEFAULTS
SET PATIENT NAME
SERVICE MODE


Version 7/17:
MAIN MENU
WAVEFORMS ON/OFF
DISPLAY: INDIVIDUAL
COLOR: CLINICAL
PARAMETERS ON/OFF
GRAPH SETUP
MONITOR DEFAULTS
PRINT CRG PLUS
LEARN THE MONITOR
SOFTWARE REVISION
SOFTWARE COMPATIBILITY
SERVICE MODE

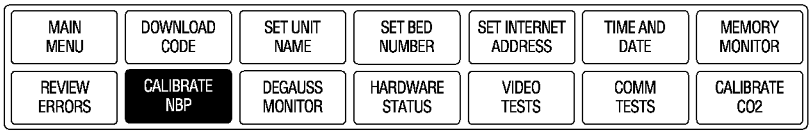
3. You have to enter a password to get into the service mode. The first two digits of the password are the day of the month, and the second two digits are the month. For example, on 7 March, the password would be 0703.
   - Rotate the Trim Knob control to highlight a password digit.
   - Press the Trim Knob control to select the password digit.
   - Rotate the Trim Knob control to change the value of the password digit.
   - Rotate the Trim Knob control to enter the password digit.
   - Repeat the steps above until all of the digits are entered.
   - Rotate the Trim Knob control to highlight SERVICE MODE from the menu.
   - Press the Trim Knob control to enter the service mode.


0 7 0 3
SERVICE MODE

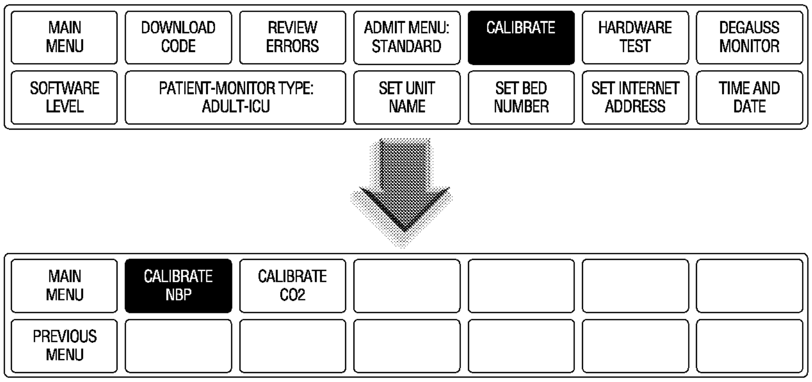
4. If you have version 6 software, rotate the Trim Knob control to highlight CALIBRATE NBP, and then press the Trim Knob control to select it.

   If you have version 7/17 software, rotate the Trim Knob control to highlight CALIBRATE, and press the Trim Knob control to select it. Then rotate the Trim Knob control to highlight CALIBRATE NBP, and press the Trim Knob control to select it.

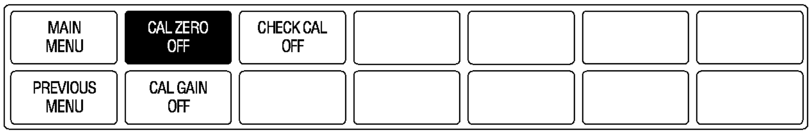
Version 6:


MAIN MENU
DOWNLOAD CODE
SET UNIT NAME
SET BED NUMBER
SET INTERNET ADDRESS
TIME AND DATE
MEMORY MONITOR
REVIEW ERRORS
CALIBRATE NBP
DEGAUSS MONITOR
HARDWARE STATUS
VIDEO TESTS
COMM TESTS
CALIBRATE CO2

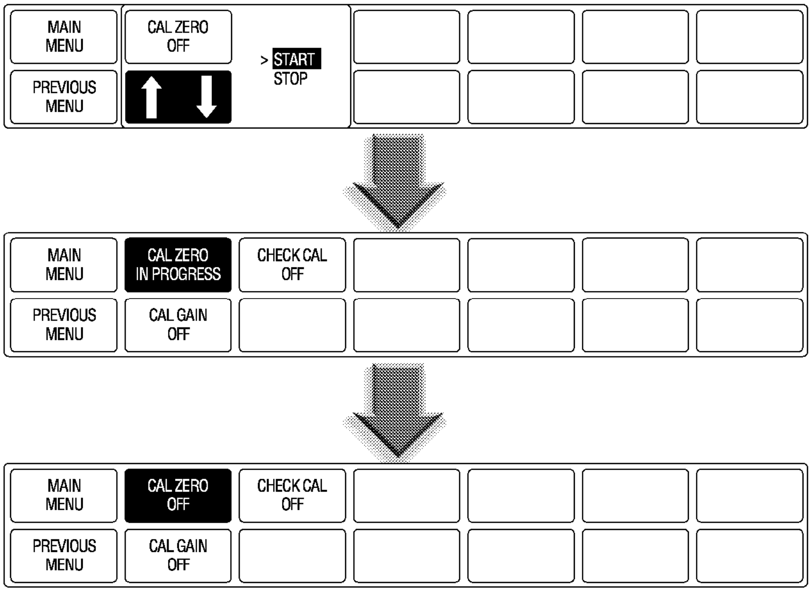
Version 7/17:


MAIN MENU
DOWNLOAD CODE
REVIEW ERRORS
ADMIT MENU: STANDARD
CALIBRATE
HARDWARE TEST
DEGAUSS MONITOR
SOFTWARE LEVEL
PATIENT-MONITOR TYPE: ADULT-ICU
SET UNIT NAME
SET BED NUMBER
SET INTERNET ADDRESS
TIME AND DATE
MAIN MENU
CALIBRATE NBP
CALIBRATE CO2
PREVIOUS MENU

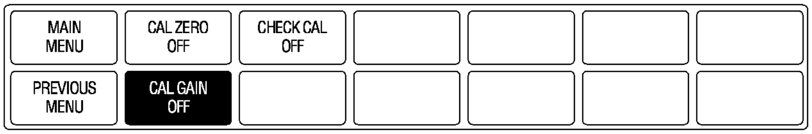
5. Rotate the Trim Knob control to highlight CAL ZERO OFF, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
PREVIOUS MENU
CAL GAIN OFF

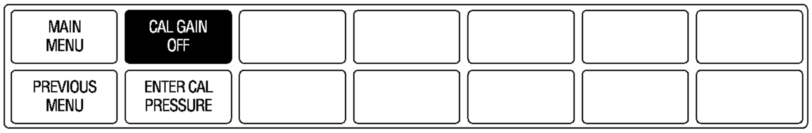
6. Rotate the Trim Knob control to highlight START, and then press the Trim Knob control to select it. The CAL ZERO menu item will show that it is IN PROGRESS, and when it is done it will display OFF again.


MAIN MENU
CAL ZERO OFF
> START
STOP
PREVIOUS MENU
MAIN MENU
CAL ZERO IN PROGRESS
CHECK CAL OFF
PREVIOUS MENU
CAL GAIN OFF
MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
PREVIOUS MENU
CAL GAIN OFF

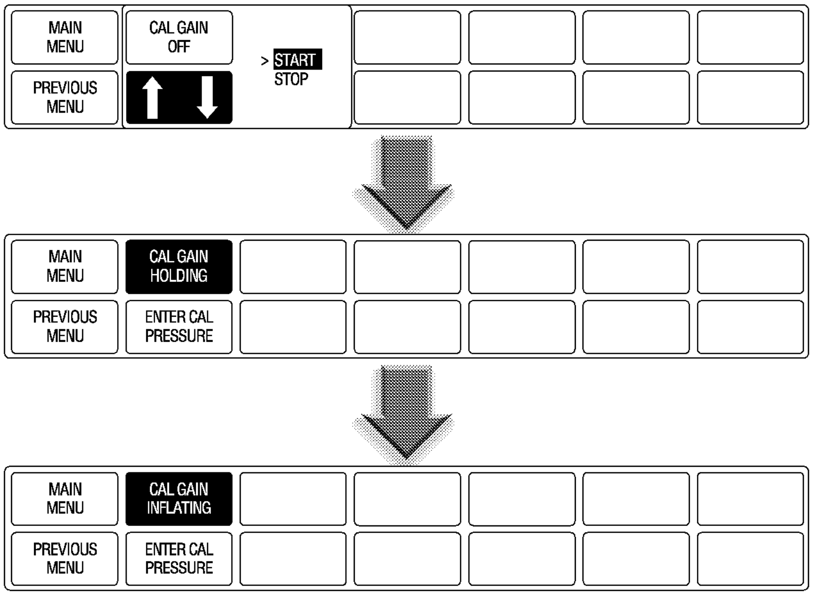
7. Rotate the Trim Knob control to highlight CAL GAIN OFF, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
PREVIOUS MENU
CAL GAIN OFF

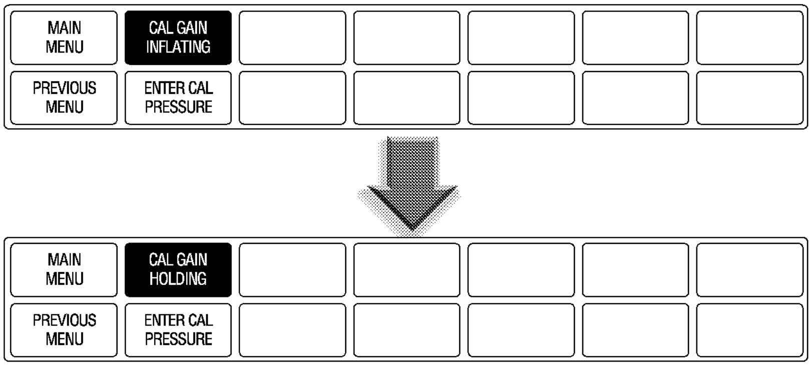
8. Rotate the Trim Knob control to highlight CAL GAIN OFF, and then press the Trim Knob control to select it.


MAIN MENU
CAL GAIN OFF
PREVIOUS MENU
ENTER CAL PRESSURE

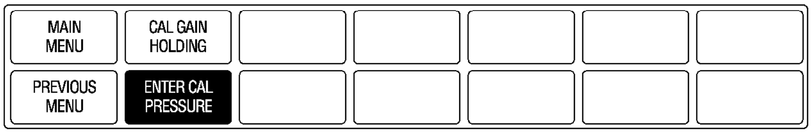
9. Rotate the Trim Knob control to highlight START, and then press the Trim Knob control to select it. The second line of text on the CAL GAIN menu item changes from HOLDING to INFLATING. Then, the Tram module starts pumping up the pressure bulb or cuff—you'll hear the whirring sound of the NBP pump motors, and you'll see an increase in displayed pressures on both the Tramscope or Solar display and the manometer.


MAIN MENU
CAL GAIN OFF
> START
STOP
PREVIOUS MENU
MAIN MENU
CAL GAIN HOLDING
PREVIOUS MENU
ENTER CAL PRESSURE
MAIN MENU
CAL GAIN INFLATING
PREVIOUS MENU
ENTER CAL PRESSURE

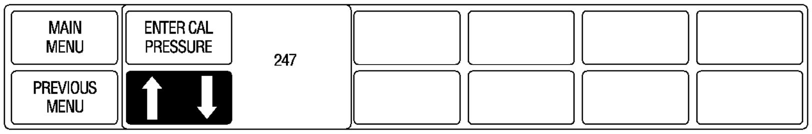
10. The pump shuts off at about 250 mmHg, and the pressure drops slowly to about 240 mmHg before stabilizing. The second line of text on the CAL GAIN menu item changes from INFLATING back to HOLDING. If the pressure continues to drop at a rate of 1 mmHg or more for every five seconds, there is a leak in the NBP plumbing. If there is a leak in the NBP plumbing, you'll have to repair it and restart this calibration procedure.


MAIN MENU
CAL GAIN INFLATING
PREVIOUS MENU
ENTER CAL PRESSURE
MAIN MENU
CAL GAIN HOLDING
PREVIOUS MENU
ENTER CAL PRESSURE

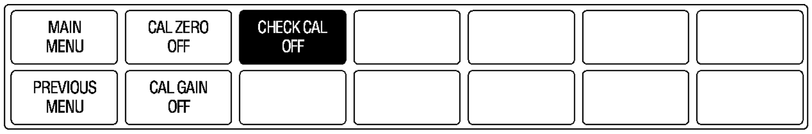
11. Rotate the Trim Knob control to highlight ENTER CAL PRESSURE, and then press the Trim Knob control to select it.


MAIN MENU
CAL GAIN HOLDING
PREVIOUS MENU
ENTER CAL PRESSURE

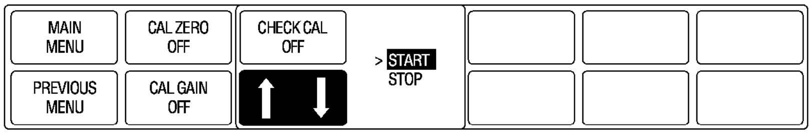
12. An ENTER CAL PRESSURE popup window will appear. Use the Trim Knob control to select a pressure value that is 1 mmHg lower than the current manometer reading.


MAIN MENU
ENTER CAL PRESSURE
247
PREVIOUS MENU
↑ ↓

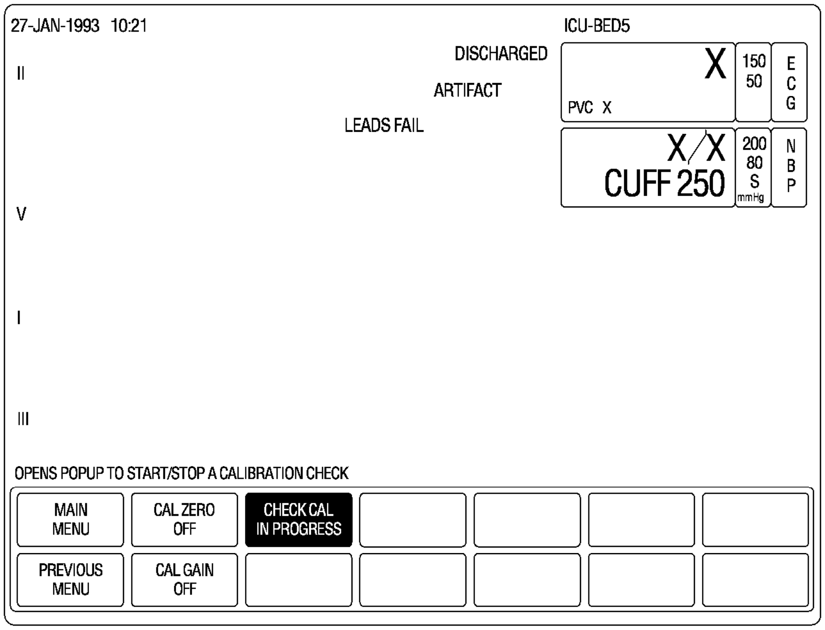
13. When the manometer falls to exactly the value that you selected in the popup window, press the Trim Knob control to enter the value.
14. Rotate the Trim Knob control to highlight CHECK CAL OFF, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
PREVIOUS MENU
CAL GAIN OFF

15. Rotate the Trim Knob control to highlight START, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
> START
STOP
PREVIOUS MENU
CAL GAIN OFF
↑ ↓

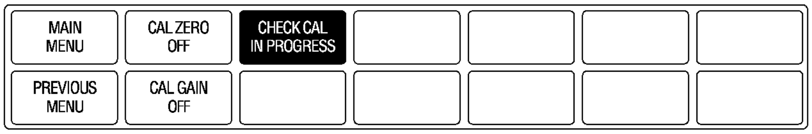
16. The text on the menu item will change from CHECK CAL OFF to CHECK CAL IN PROGRESS. Make sure that the pressure readings (shown as CUFF in the NBP parameter box) on the Tramscope or Solar display and manometer are equal (± 1 mmHg) for at least one full minute.


27-JAN-1993 10:21

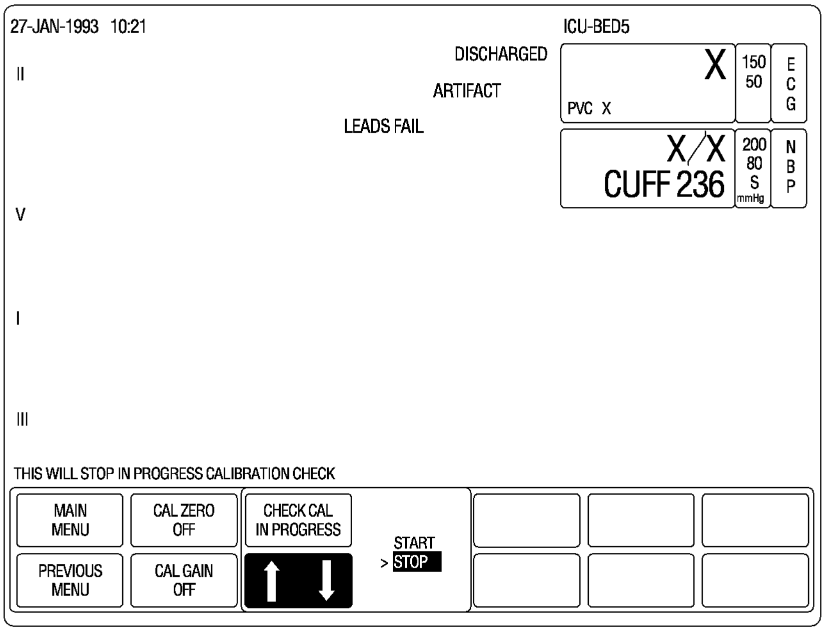
ICU-BED5

OPENS POPUP TO START/STOP A CALIBRATION CHECK
DISCHARGED
ARTIFACT
LEADS FAIL
II
X
PVC X
150
50
ECG
X/X
CUFF 250
200
80
S
mmHg
NBP
V
I
III
MAIN MENU
CAL ZERO OFF
CHECK CAL IN PROGRESS
PREVIOUS MENU
CAL GAIN OFF

17. Rotate the Trim Knob control to highlight CHECK CAL IN PROGRESS, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL IN PROGRESS
PREVIOUS MENU
CAL GAIN OFF

18. Rotate the Trim Knob control to highlight STOP, and then press the Trim Knob control to select it. The module then releases pressure in the bulb or cuff.


27-JAN-1993 10:21
ICU-BED5
DISCHARGED
ARTIFACT
LEADS FAIL
II
V
I
III
X
150
50
E
C
G
PVC X
X/X
CUFF 236
200
80
S
mmHg
N
B
P
MAIN MENU
CAL ZERO OFF
CHECK CAL IN PROGRESS
PREVIOUS MENU
CAL GAIN OFF
START
> STOP

THIS WILL STOP IN PROGRESS CALIBRATION CHECK

This completes the NBP calibration procedure. Remove the cuff and manometer from the Tram module.

NBP Test for Series 70XX Monitors

You should run this test if you use your Tram module with a Series 70XX-type monitor (Series 7000, 7000RA, 7005, 7010, or 7010RA monitors).

1. Press the SYSTEM key on the monitor.
2. Press the MONITOR SETUP, MONITOR SERVICE, and then CALIBRATE NBP soft keys. Soft keys are the unlabeled keys under the display. The function of each key appears on the display, just above the key.
3. If an NBP cuff is attached to the Tram module, remove it.
4. Press the YES soft key.
5. Press the SET ZERO soft key. The module will then take about 10 seconds to internally set its zero reference point. After this reference point is set, the SET ZERO will no longer be highlighted — it will be return to the same intensity as the rest of the characters on the display.
6. Turn the manometer on, and set its range switch to the 1000 mmHg setting.
7. Press the SET PRESSURE soft key. Make sure the Tram module starts to pump up the pressure bulb or cuff. You can tell it's pumping by the whirring sound of the NBP pump motors, and the increase in displayed pressures on the monitor and manometer.
8. The pump should shut off at approximately 250 mmHg, and the pressure will begin to drop slowly to about 240 mmHg before stabilizing. If the pressure continues to drop at a rate of 1 mmHg or more for every four seconds, there is a leak in the system. If there is a leak in the system, repair it and restart the calibration procedure.
9. At the monitor, key in a pressure value that is 1 mmHg lower than the current manometer reading.
10. When the manometer falls to exactly the value that you keyed into the monitor, press the ENTER key on the monitor.
11. Press the TEST CAL soft key and verify that the pressure readings on the monitor and manometer are equal (± 1 mmHg) for at least one minute.
12. Press the TEST CAL soft key to stop the test.
13. Press the CLEAR key.

This completes the NBP calibration procedure. Remove the cuff and manometer from the Tram module.

Software Update Procedure

This procedure is provided for any Tram modules that may require updating. It describes how to download new software into Tram 100-850 A or SL module by using a laptop personal computer or terminal with programmed software diskettes.

Required Special Tools/ Equipment

This update procedure requires the user to have the following to download the Tram software.

- Tram module update diskette (Call your sales representative for the latest update kit part numbers and for software compatibility issues.)
- a personal computer (PC) to download the software, and
- a download cable kit, pn 404307-001.

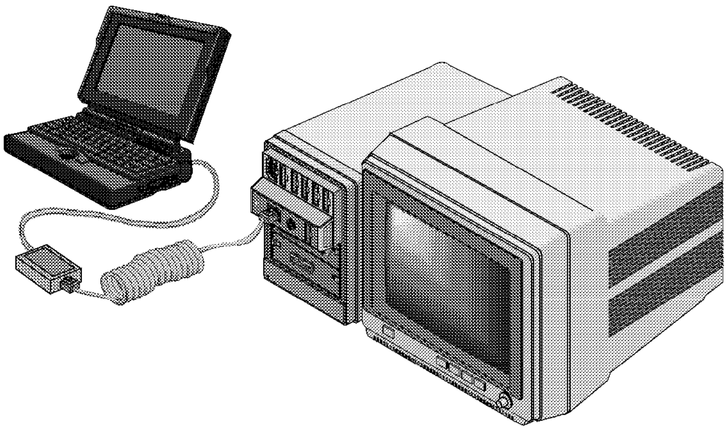
The laptop computer (PC) must have the following minimum requirements:

- it must be MS-DOS compatible,
- have a 720K, 3.5-inch diskette drive, and
- have an RS-232 serial port.

Interconnection

To connect the PC to the Tram module, do the following steps in the order given.

- Connect the Tram module cable (part of the download kit) to the display connector on the front of the Tram module.
- Connect the other end of the Tram module cable to the RS-232C to RS-422 converter. Note the RS-232C to RS-422 converter is powered by the module and does not require connection to a power source.
- Connect the PC cable assembly from the RS-232C to RS-422 converter to the D-type connector labeled COMMS or COMM 1 at the rear of the PC.



PC Setup

1. Insert the Tram module into an updated Tram-rac chassis (or Series 70XX monitor.) Ensure the power light on the front of the Tram module illuminates.
2. Insert the Tram module update diskette into drive A of the PC.
3. If the PC prompt is not A:\>, type A:\ and press the ENTER key. The PC will respond with an A:\> prompt.
4. Type UPDATE and press the ENTER key. The update program is loaded and will list the Tram Critical Care Monitor UPDATE UTILITIES menu.
5. Press the F7 key until the serial port name that the download converter module is connected to appears in the lower right box of the main menu.

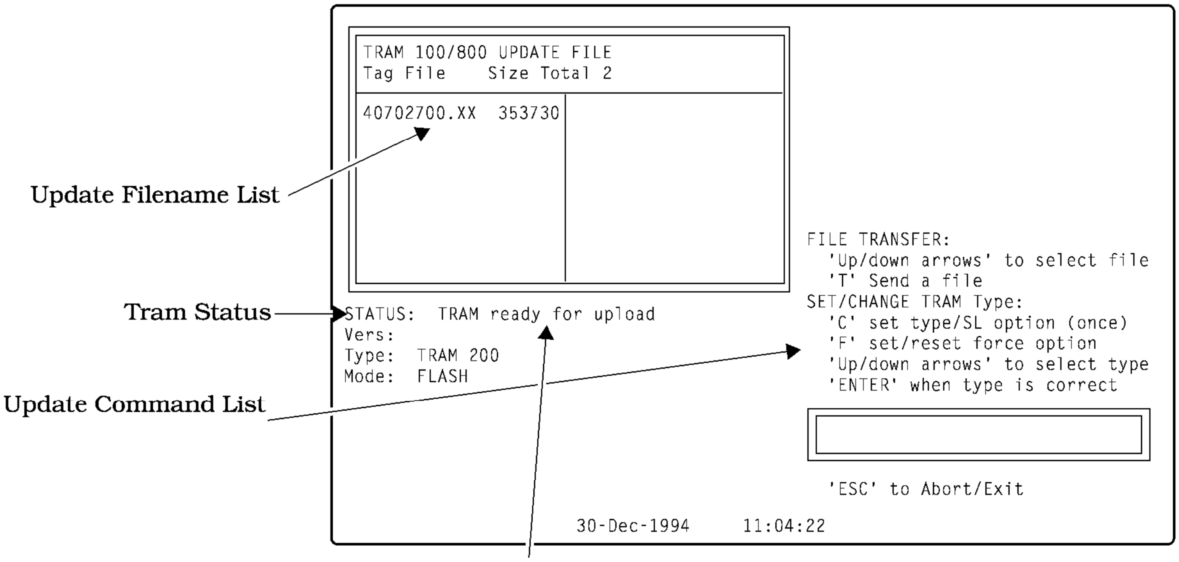
Generic Procedure

Do the following to update each Tram module.

1. Press the F5 key to select TRAM UPDATE menu.

NOTE: If the PC locks up, turn it OFF, remove the diskette from the drive, and start again. (REBOOT)

2. You should see a screen similar to the following.



```
TRAM 100/800 UPDATE FILE
Tag File    Size Total 2

40702700.XX  353730

                                              FILE TRANSFER:
                                                'Up/down arrows' to select file
                                                'T' Send a file
STATUS:  TRAM ready for upload                SET/CHANGE TRAM Type:
Vers:                                           'C' set type/SL option (once)
Type:  TRAM 200                                 'F' set/reset force option
Mode:  FLASH                                    'Up/down arrows' to select type
                                                'ENTER' when type is correct

                                                'ESC' to Abort/Exit

                      30-Dec-1994     11:04:22
```

NOTE: The version field in the above display should contain data describing the current version of software in the Tram module.

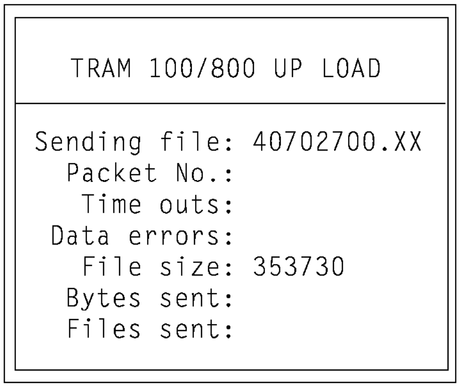
3. Watch the Tram module status. You should see the following messages.

   Trying to Talk to Tram
   Getting Software Revision
   Getting Tram Type
   Tram Ready for Upload

   Just below Tram status, you will see the current software version, Tram type, and mode.

4. Use the ↓ key to highlight the file that you want to upload and type T or <ENTER> to tag and send the file. The Tram module status will display an UPLOADING TO TRAM message.

5. In the upper right corner of the computer's screen, a box containing file name, number of bytes, and other download parameters will appear. These fields will be updated while the software is uploaded. Below that box there is a message area that shows LOADING FILE and then USING CCITT-CRC as the upload begins.



```
   TRAM 100/800 UP LOAD

Sending file: 40702700.XX
  Packet No.:
   Time outs:
 Data errors:
   File size: 353730
  Bytes sent:
  Files sent:
```

* XX indicates the software version.

6. As the PC downloads software to the Tram module, the PACKET NO. and BYTES SENT fields are incremented. The data errors field may also be incremented during the upload. Data errors cause packets to be automatically sent again to the Tram module, so an occasional data error should be disregarded. However, if the data errors are continuous, the Tram module should be serviced.

   If the TIME OUTS field is continuously incremented, it detects a communication error. Disconnect the Tram module, press the ESC key, and start this procedure again.

7. When the software download is complete, the following messages are displayed for the Tram module status.

   Waiting for Tram to restart
   Telling Tram to run in flash
   Getting Software Revision
   Setting Tram Type
   Getting Tram Type
   Tram Upload Complete

   The PC will sound a tone to show that the software upload is complete.

8. Ensure Tram module type, shown below Tram module status. If the Tram module type displayed does not match the type of Tram module that you are updating, it will have to be changed as follows.
   - Type C (or c) to display the Tram type selections (i.e. 100/200/250/300/400/450/500/600/750/800/850.) The selections are also repeated with the SL option. The Tram must be SL capable (hardware/memory changes) to be set with the SL option.
   - Use the ↓ and ↑ keys to scroll through the various Tram types (e.i. 100, 200SL, etc.).
   - The updated Tram type is displayed for the Tram status. A Tram that is not SL capable will respond with the Tram type (e.i. 100), but will NOT have the SL option. The message SL OPTION IS NOT ALLOWED will appear below the mode type.
   - The following sequence should appear for the Tram module status.

     Setting Tram Type
     Getting Software Revision
     Getting Tram Type
     Tram Ready For Upload (or Tram upload complete)

   The software download is now complete.

   If you are updating several Tram modules, you may force all Tram modules to one type by selecting an ‘F.’ When this option is set, the Tram module’s type is forced to one specified type (i.e. 200SL). This option remains set until it is reset by hitting ‘F’ again.

9. Disconnect the Tram module from the download module.
10. Press the ESC key on the PC to return to the main menu.

Completion

This completes the Tram module software update.

1. Continue with the software update for other modules.
2. Before returning a module to service, perform the Checkout Procedure provided in Chapter 5: “Preventive Maintenance.”

For your notes

5 PREVENTIVE MAINTENANCE

Equipment Maintenance Program **5-3**
Recommended Maintenance Schedule 5-3
Recommended Frequency 5-3

Inspection and Cleaning **5-4**
Visual Inspection 5-4
Cleaning Precautions 5-4
Exterior Cleaning 5-4

Checkout Procedure **5-5**
Test Frequency 5-5
Required Tools/Special Equipment 5-5
General Test 5-8
Parameter Tests 5-8
ECG Test 5-9
12SL ECG Test 5-11
Respiration Test 5-12
Blood Pressure Test 5-13
Temperature Test 5-14
Cardiac Output Test 5-15
SpO_2 Test 5-16
NBP Tests 5-18
  NBP Test for Tram Critical Care Monitors 5-20
  NBP Test for Series 70XX Monitors 5-24
DEFIB SYNC Test 5-25
Fan Test 5-26
Transport Test 5-26
Completion 5-26

Domestic Electrical Safety Tests **5-27**
Test Frequency 5-27
  Required Tests 5-27
  Test Conditions 5-27

AC Line Voltage Test **5-28**
  120 VAC, 50/60 Hz 5-28
  240 VAC, 50/60 Hz 5-28

Ground Continuity Test **5-29**

Current Leakage Tests 5-30
Preparation 5-30
Required Tools/Equipment 5-30
Current Limits 5-31
Patient-Cable-Leakage to-Ground Test 5-31
Patient-Cable-Leakage-into-Patient Leads Test 5-33
Completion 5-34

Hi-Pot Tests 5-35
Preparation 5-35
Test Frequency 5-35
Required Tools/Equipment 5-35
Generator Setup.. 5-36
Ground Connection..5-36
High Voltage Connection 5-36
AC Hi-Pot Test.. 5-37
DC Hi-Pot Test 5-38

Repair Log/PM Inspection Form 5-39

Equipment Maintenance Program

Recommended Maintenance Schedule

A regular equipment maintenance program helps prevent unnecessary equipment and power failures and also reduces possible health hazards. The maintenance schedule for the Tram 100-850 A and SL modules include the following:

- Inspection; Do this before each time the module is used with a patient.
- General cleaning; Do this before each time the module is used with a patient.
- Checkout procedures; Do these when you first get your module (before you use it to monitor patients), every six months thereafter, and each time you remove and replace a circuit board.
- Current leakage tests; Do these when you first get your module (before you use it to monitor patients), every six months thereafter, and each time you remove and replace a circuit board. Leakage tests verify that the equipment does not propose a health hazard.
- Hi-pot tests; Do these each time you open the acquisition module.
- NBP calibration (refer to Chapter 4: “Calibration”); Do this when you first get your module (before you use it to monitor patients), every year thereafter, and each time you remove and replace a circuit board.

Recommended Frequency

To help you establish a systematic maintenance routine, Marquette Electronics recommends that you perform all maintenance procedures presented in this chapter.

- upon receipt of the module,
- every six months thereafter,
- each time a circuit board is removed or replaced, and
- record the results on the “Preventive Maintenance Inspection Form,” included at the end of this chapter.

WARNING
Failure to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards. Unless you have an Equipment Maintenance Contract, Marquette Electronics does not in any manner assume the responsibility for performing the recommended maintenance procedures. The sole responsibility rests with the individual or institution using the equipment. Marquette Electronics service personnel may, at their discretion, follow the procedures provided in this manual as a guide during visits to the equipment site.

Inspection and Cleaning

Visual Inspection

Remove module before making an inspection or cleaning the module.

- Check the case for cracks or other damage.
- Regularly inspect cables for fraying or other damage.
- Inspect all plugs, cables, and connectors for bent prongs or pins.
- Make sure the latches work properly:
    - When you install the Tram module in a monitor, it should be latched firmly into place and should not slide out of the monitor without pressing the latch buttons.
    - When you press the latch buttons, the Tram module should slide easily out of the monitor
- Verify that all cables and connectors are securely seated. Note that replacement of components should be performed only by qualified service personnel.

Cleaning Precautions

To avoid damage to the equipment surfaces, do not use the following cleaning agents:

- organic solvents,
- ammonia based solutions,
- acetone solution,
- alcohol based cleaning agents,
- Bentadine solution,
- a wax containing a cleaning substance, or
- abrasive cleaning agents.

Table 5-1. Recommended Cleaning Supplies

Item	Part Number
Ammonia (diluted) or Cidex solution, or Sodium hypochlorite bleach (diluted), or Mild soap (diluted)	–
Lint-free cloth	TX609
Dust remover (compressed air)	–

Exterior Cleaning

Clean the exterior surfaces with a clean, lint-free cloth and one of the cleaning solutions listed above.

- Wring the excess water from the cloth. Do not drip any liquid into open vents, plugs, or connectors.
- Dry the surfaces with a clean cloth or paper towel.

Checkout Procedure

The following pages describe the checkout procedures for the Tram module. We provide you with these procedures so you can verify the operational performance of the Tram module. If you do not get the results listed in the procedures, your Tram module might not be working properly.

The checkout procedures consist of several tests. You should perform all of the tests applicable to your Tram module in the order in which they are listed.

Test Frequency

This procedure tests the functions of each parameter of the module. We recommend this checkout procedure be performed:

- upon receipt of the module,
- every six months thereafter, and
- each time the module is open or repaired.

Remember to record the date and results on the "Maintenance/ Repair Log" included at the end of this chapter.

Required Tools/Special Equipment

These procedures are based on the assumption that the module under test is used with known good cables and known good test equipment. It also assumes that you are at least somewhat familiar with the operation of all devices required for the procedures. For more information concerning the operation of these components, consult the appropriate operator's manuals.

The following paragraphs list the test equipment, adapters, and cables necessary to complete the checkout procedures. You can use equivalent equipment, but the procedures were written for the test equipment listed here, so you might have to slightly modify some test steps, because the values listed in the steps take into account the accuracy of the simulators, as well as the accuracy of the module. The "Technical Specifications" in Chapter 2: "General Information" for details about the module's accuracy specifications.

1. You will need a monitor to plug the Tram module into. You may use any of these monitors:
    - a Tram Critical Care monitor (a Tramscope display with a Tram-rac housing).
    - a Series 7000 or 7000RA monitor that has been modified to be Tram-compatible, or
    - a Series 7005, 7010, or 7010RA monitor.

2. You will need the simulators and cables listed below to provide waveforms and patient vital signs.

CAUTION
You should never use a patient simulator as a calibration reference because they are generally not precise enough to be trusted as a reference. Make sure that your simulator is accurate by testing it on a known-good monitor.

Table 5-2. Suggested Simulators and Cables

Item	Part Number
Multifunction Micro-Simulator	MEI PN MARQ-1
Cardiac Output Simulator II	MEI PN 900028-001
SpO_2 Simulator	MEI PN 408610-001
ECG Patient Cable	MEI compatible
ECG Leadwire Set	MEI compatible
Blood Pressure Simulator Cable	MEI PN 700095-001
Temperature Adapter	MEI PN 402015-004
Temperature Simulator Cable	MEI PN 6770031
Cardiac Output Cable Adapter	MEI PN 700092-001
MEI (Nellcor-style) SpO_2 Simulator Cable OR (Ohmeda-Style SpO_2 Simulator Cable)	MEI PN 700232-004 OR MEI PN 700232-002)

3. You can use any patient cable or leadwire set that you would usually use on patients.
4. You need these items to build an NBP test fixture:

Table 5-3. Description

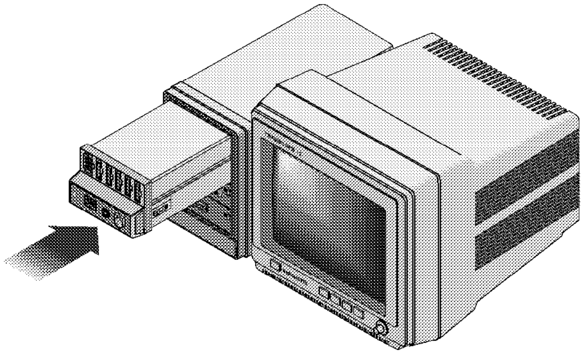
Item	Part Number	Qty
NBP Cuff Coupling	MEI PN 400787-001	1
NBP Hose Coupling	MEI PN 46100-002	1
NBP Tee	MEI PN 4745-101	1
NBP Tubing	MEI PN 401582-001	2

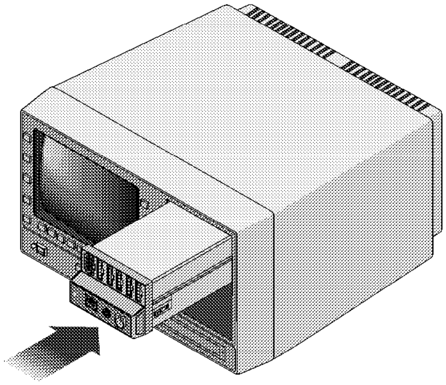
5. You need an accurate manometer for the NBP test. A digital one, like the Sensym PDM200M is nice, but you can use a mercury manometer, too.

6. You need an NBP tube for the NBP test:
   - If you have a Tram 100 or 200 module, you will need pn 9461-203.
   - If you have a Tram 400A module with an NBP connector that protrudes from the front of the module, you will need pn 9461-208.
   - If you have a Tram 400 A or SL module with a recessed NBP connector, or if you have a Tram 800 A or SL module, you will need pn 9461-212.
7. You need an NBP cuff for the NBP test. Any size will work. If you do not have one, order pn 9461-301.
8. You need something to wrap the cuff around during that test. PVC pipe from your local hardware store works good.
9. You need an oscilloscope for the DEFIB SYNC test. Since you will use it to view low-frequency ECG and BP waveforms, almost any kind of oscilloscope will work.
10. You need a Smart-pac transport display, or a Series 7200 Tram transport display fitted with a Smart-pac battery backpack.
11. You need a cable to connect your Tram module to the transport display. If you do not already have one, pn 403495-001 is a 3-meter (10-foot) cable.

General Test

1. Install the module in a Tram-rac 4 housing or Series 70XX-type monitor.





2. Apply power to monitor by turning the rear panel power switch to the ON position.
3. Turn the display ON by pressing the DISPLAY ON/OFF or POWER key on the front panel of the monitor.
4. Make sure the power indicators ON both the monitor and the Tram module are turned ON.
5. Connect patient cable to module.
6. Attach appropriate leads to the simulator.

Parameter Tests

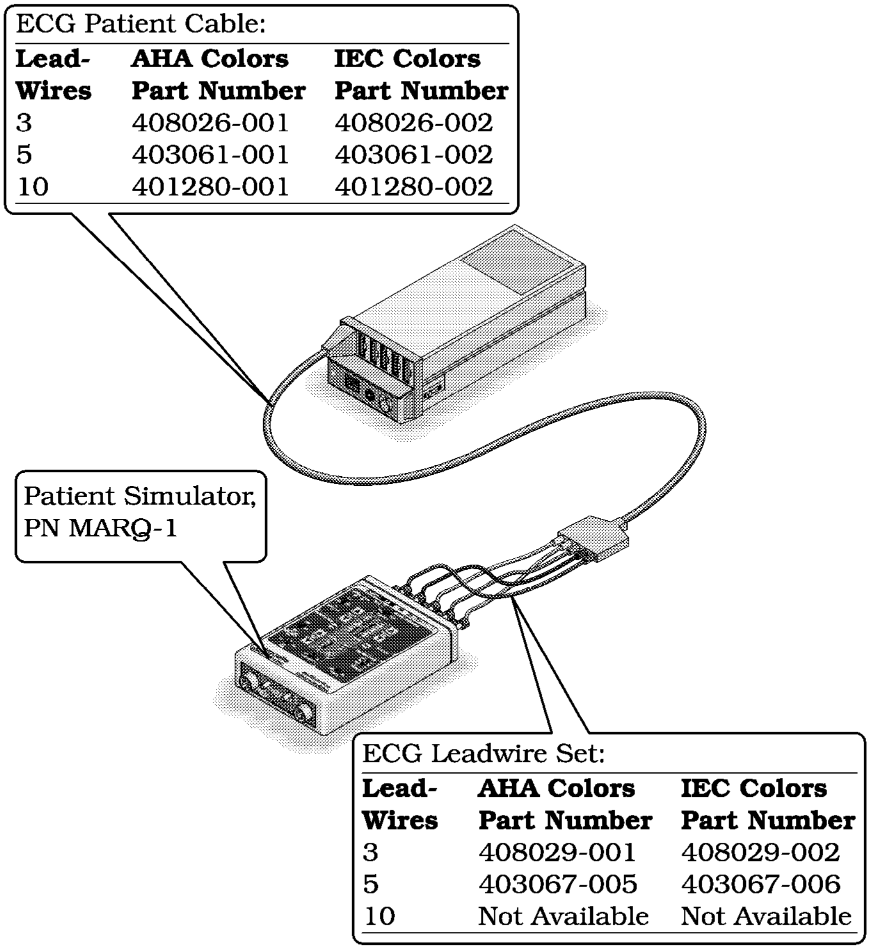
Select the appropriate tests to verify all parameters of the module under test. The parameter tests are presented in the following order.

- ECG Test
- 12SL ECG Test
- Respiration Test
- BP Test
- Temperature Test
- CO Test
- SpO_2 Test
- NBP Test

CAUTION
Make sure to test all parameters per module.

ECG Test

1. Set up the simulator like this:
   - Set heart rate to 80 bpm.
   - Set ECG amplitude to 1.0 mV.
2. Attach a patient cable and leadwires between the ECG connector on the Tram module and the leadwire connectors on the top of the patient simulator.



ECG Patient Cable:

Lead-Wires	AHA Colors Part Number	IEC Colors Part Number
3	408026-001	408026-002
5	403061-001	403061-002
10	401280-001	401280-002

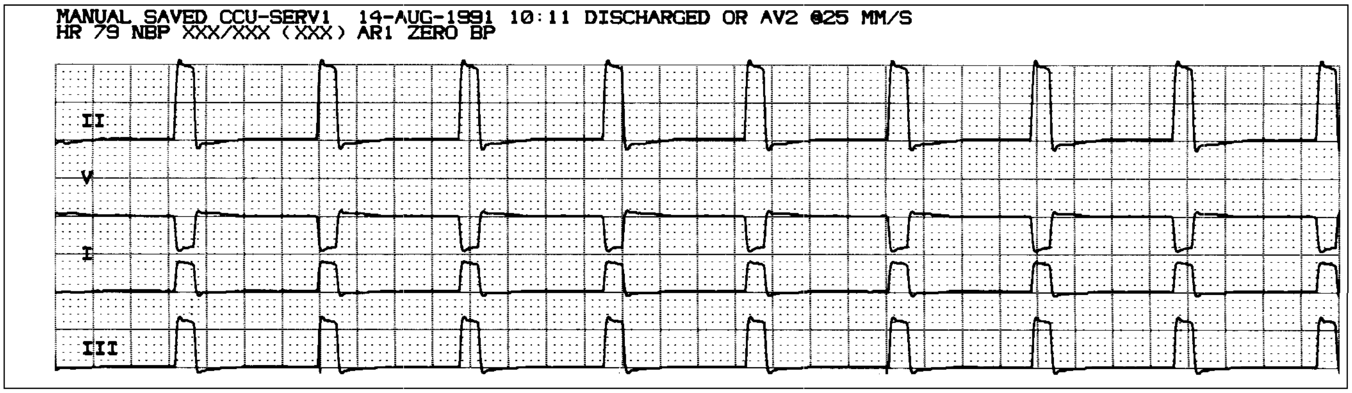
Patient Simulator, PN MARQ-1

ECG Leadwire Set:

Lead-Wires	AHA Colors Part Number	IEC Colors Part Number
3	408029-001	408029-002
5	403067-005	403067-006
10	Not Available	Not Available

3. Admit a patient into system.
4. Make sure the following conditions are true:
   - The monitor displays ECG lead II, and it is noise-free.
   - The monitor displays an 80 ±1 bpm heart rate.
   - If the monitor has QRS tones are turned ON, an audible tone sounds with each QRS complex.
5. Make sure all seven ECG leads are available for display and they are noise-free.
6. Set DETECT PACE to NORMAL.
7. Inject a VP2 pacemaker pulse with the simulator.

8. Observe following with leads II, III, aVR, aVF, and V:
    - On the monitor, a P appears above the PVC count to denote pacemaker mode.
    - The monitor still shows an 80 ±1 bpm heart rate.
9. Remove the pacemaker pulse input and return the simulator to these conditions:
    - Set heart rate to 80 bpm.
    - Set amplitude to 1.0 mV.
10. Select lead II for display in the top trace position.
11. Remove the RA leadwire from the patient cable.
12. Observe following:
    - The monitor displays an RA FAIL message.
    - The monitor displays lead III in place of lead II.
13. Replace the RA leadwire.
14. Inject a 1-millivolt calibration pulse with the simulator and start a manual graph.
15. Observe that the calibration pulses are properly displayed and graphed, like in the example below.

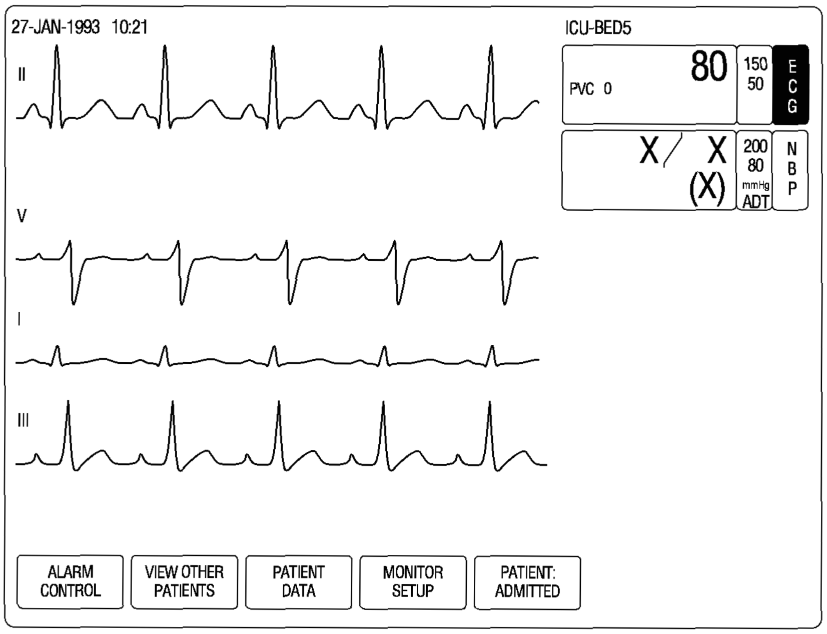


```
MANUAL SAVED CCU-SERV1  14-AUG-1991 10:11 DISCHARGED OR AV2 @25 MM/S
HR 79 NBP XXX/XXX (XXX) AR1 ZERO BP
```

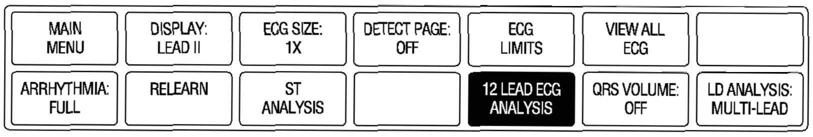
12SL ECG Test

This test is only necessary for SL-type Tram modules. It requires that the Tram module use version 7 (or later) software, and that the monitor uses a Tramscope 12 or 12C display with version 7 or 17 (or later), Series 7030 software.

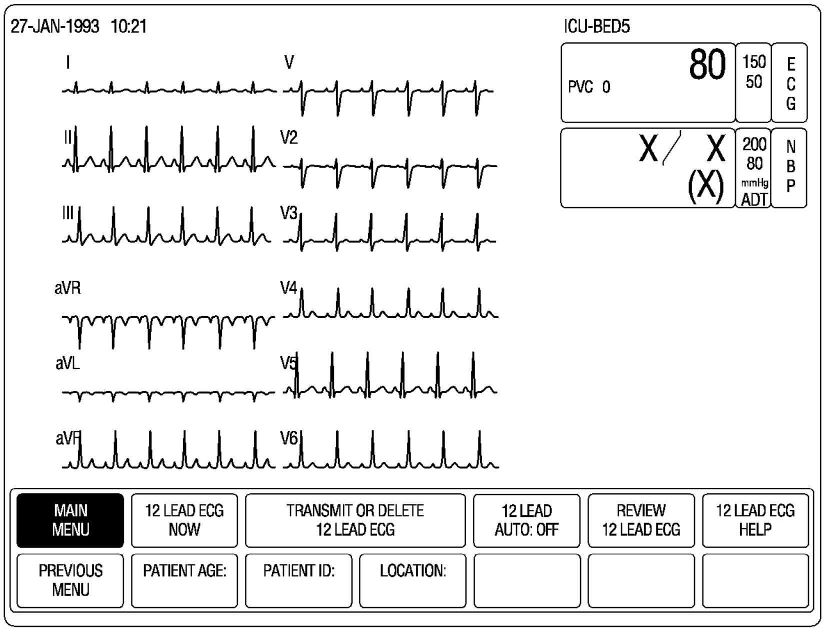
1. At the monitor, return to the Main Menu.
2. Turn the Trim Knob control to highlight the ECG parameter box, and press the Trim Knob control to select it.


27-JAN-1993 10:21
ICU-BED5
II
V
I
III
PVC 0
80
150
50
ECG
X/ X
(X)
200
80
mmHg
ADT
NBP
ALARM CONTROL
VIEW OTHER PATIENTS
PATIENT DATA
MONITOR SETUP
PATIENT: ADMITTED

3. At the ECG menu, rotate the Trim Knob control to highlight 12 LEAD ECG ANALYSIS, and then press the Trim Knob control to select it.


MAIN MENU
DISPLAY: LEAD II
ECG SIZE: 1X
DETECT PAGE: OFF
ECG LIMITS
VIEW ALL ECG
ARRHYTHMIA: FULL
RELEARN
ST ANALYSIS
12 LEAD ECG ANALYSIS
QRS VOLUME: OFF
LD ANALYSIS: MULTI-LEAD

4. Make sure that all 12 ECG traces are noise-free, and they are displayed clearly.

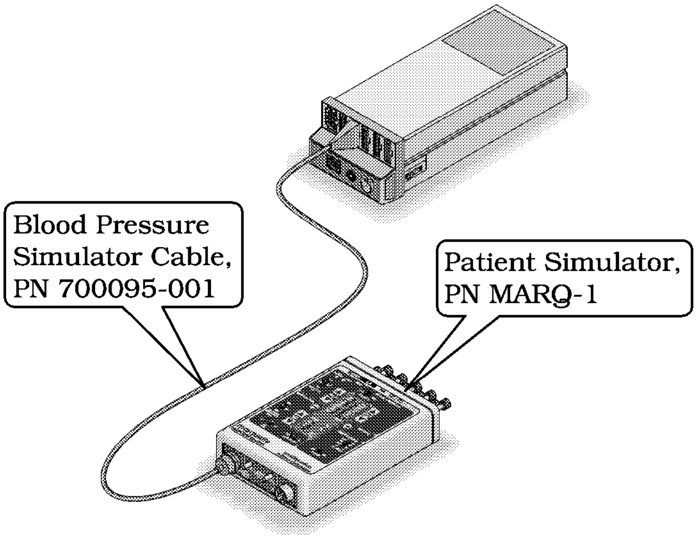

27-JAN-1993 10:21
ICU-BED5
I
II
III
aVR
aVL
aVF
V
V2
V3
V4
V5
V6
80
PVC 0
150
50
ECG
X/ X
(X)
200
80
mmHg
ADT
NBP
MAIN MENU
12 LEAD ECG NOW
TRANSMIT OR DELETE 12 LEAD ECG
12 LEAD AUTO: OFF
REVIEW 12 LEAD ECG
12 LEAD ECG HELP
PREVIOUS MENU
PATIENT AGE:
PATIENT ID:
LOCATION:

Respiration Test

1. Set up simulator like this:
   - Set baseline impedance to 750Ω.
   - Set ΔR to 0.5Ω.
   - Set lead select to I & II.
   - Set respiration rate to 30 breaths per minute.
2. Set up the monitor like this:
   - Turn the respiration waveform ON.
   - Set the respiration waveform to lead II.
3. Observe these conditions:
   - The monitor displays a distortion-free respiration waveform.
   - The monitor displays a respiration rate reading of 30 ±2 breaths per minute.
4. Set the respiration waveform to lead I at the monitor and observe the same conditions as in step 3.

Blood Pressure Test

1. Set up simulator like this:
   - Set polarity to POS.
   - Set output to 0 mmHg.
2. Connect a cable from the BLOOD PRESSURE 1 connector of the simulator to the left most BP connector (BP1) of the Tram module.

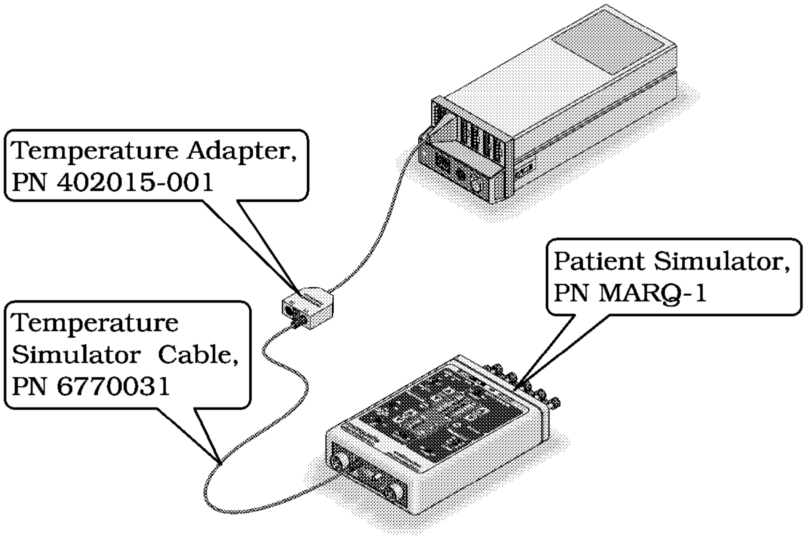

Blood Pressure Simulator Cable, PN 700095-001
Patient Simulator, PN MARQ-1

3. Observe an AR1 label and graticules on the monitor.
4. Zero the AR1 waveform.
5. Set the simulator to output 200 mmHg.
6. Observe a reading of 200/200 (200) ± 4 mmHg on the monitor.
7. Set the simulator to WAVE output.
8. Set the waveform gain on the monitor to auto.
9. Observe a distortion free waveform and a blood pressure reading of approximately 120/80 (93) on the monitor.
10. Remove the cable from the BP1 connector of the Tram module and insert it into the BP2 connector.
11. Observe a PA2 label and graticules on the monitor.
12. Set the simulator to output 0 mmHg.
13. Zero the PA2 waveform.
14. Repeat steps 5 through 9 of this test.
15. If you are testing a Tram 100A, 200A, or 200SL module, proceed to the TEMP Test.
16. Remove the cable from the BP1 connector of the Tram module and insert it into the BP3 connector.
17. Observe a CVP label and graticules on the monitor.
18. Set the simulator to output 0 mmHg.
19. Zero the CVP waveform.
20. Repeat steps 5 through 9 of this test.

21. If you are testing a Tram 400A or 400SL module, proceed to the TEMP Test.
22. Remove the cable from the BP1 connector of the Tram module and insert it into the BP4 connector.
23. Observe an LA label and graticules on the monitor.
24. Set the simulator to output 0 mmHg.
25. Zero the LA waveform.
26. Repeat steps 5 through 9 of this test.

Temperature Test

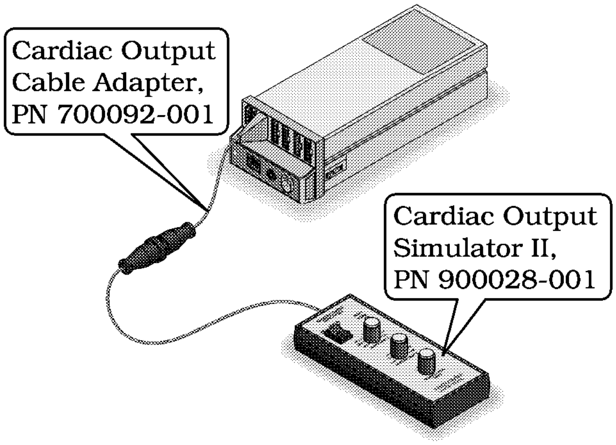
1. Set up the simulator for a 37˚C temperature output.
2. Attach a temperature sensor adaptor to the TEMP/CO connector of the Tram module.


Temperature Adapter, PN 402015-001
Patient Simulator, PN MARQ-1
Temperature Simulator Cable, PN 6770031

3. Set the switch on the adaptor to the 400 position.
4. Attach a cable from the SERIES 400 TEMPERATURE OUTPUT connector of simulator to the T1 connector of the temperature sensor adaptor.
5. Observe that a T1 reading appears on the display with reading between 36.6 and 37.4.
6. Move cable from the T1 connector of the temperature sensor adaptor to the T2 connector.
7. Observe that a T2 reading appears on the display with reading between 36.6 and 37.4.
8. Remove the temperature sensor adaptor and temperature cable from the Tram module and the simulator.

Cardiac Output Test

1. Connect a cardiac output cable adapter to the TEMP/CO connector of the Tram module and connect the CO adaptor to a cardiac output simulator II.


Cardiac Output Cable Adapter, PN 700092-001
Cardiac Output Simulator II, PN 900028-001

2. Set the cardiac output simulator to output the BT (blood temperature) readings in the following table and observe the correct readings on the monitor:

Table 5-4. Simulator Output Blood Temperature Settings

Simulator BT Setting	Monitor BT Reading Range
30.3°C	30.1 – 30.5
35.1°C	34.9 – 35.3
36.0°C	35.8 – 36.2
37.0°C	36.8 – 37.2
41.7°C	41.5 – 41.9

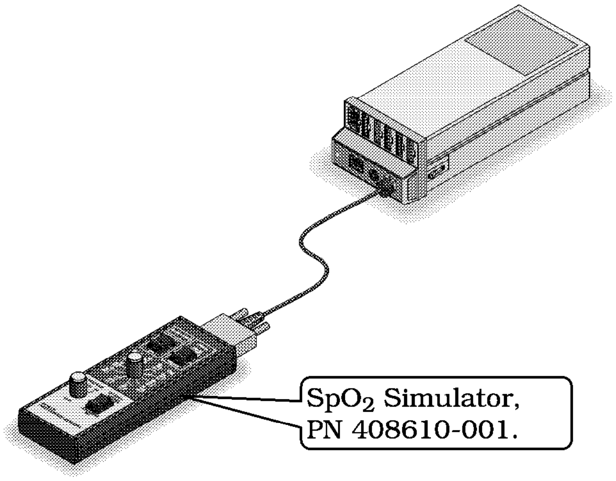
3. Set the cardiac output simulator to output the IT (injectate temperature) readings in the following table and observe the correct readings on the monitor:

Table 5-5. Simulator Injectate Temperature Settings

Simulator BT Setting	Monitor BT Reading Range
0.0°C	–0.3 – +0.3
8.0°C	7.7 – 8.3
15.0°C	14.7 – 15.3
24.0°C	23.7 – 24.3
29.6°C	29.3 – 29.9

SpO_2 Test

1. Turn the SpO_2 simulator power switch OFF.
2. Connect the simulator to the Tram module simulator cable. For Tram X50 modules, use the MEI or Nellcor square-style SpO_2 simulator cable, pn 700232-004, and for the Tram X00 modules, use the Ohmeda round-style SpO_2 simulator cable, pn 700323-002.



3. Set the simulator as follows:
   - Set the MODE to your type of probe (NELLCOR or OHMEDA).

   NOTE
   On the simulator, use the gold-colored values for OHMEDA and the white-colored values for NELLCOR. The OHMEDA values are presented in parentheses in this procedure.

   - Set the SpO_2% to 99.
   - Set the PRR to 100 beats/min.
   - Turn the power ON.
4. Verify the following are displayed at the monitor:
   - A sinusoidal waveform with an SpO_2 label.
   - An SpO_2% reading between 97 – 100% (97 and 102%).
   - A PRR reading between 97 and 103 beats per minute (it might be necessary to turn SpO_2 ON).
5. Test the accuracy of these SPO_2% settings.

Table 5-6. Accuracy of SpO_2 Settings

Simulator Setting	Displayed SpO_2 Value
99% (Both types)	97 – 100% (97 – 102%)
80.3% (84%)	78 – 82% (81 – 87%)
49.7 (63%)	48 – 52% (61 – 65%)

6. Test the accuracy of these PPR settings:

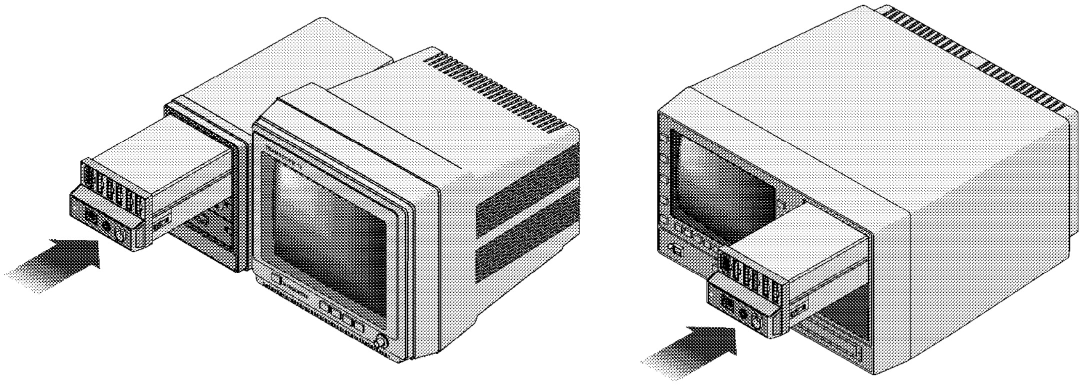
Table 5-7. Accuracy of PPR Settings

Simulator Setting	Displayed PPR Value
70	68 – 72
100	97 – 103
160	156 – 164

7. Return the simulator to these conditions:
   - Set the SpO_2% to 99.
   - Set the PPR to 100 beats/min.
8. Press the NOISE TEST button ON the simulator for 30 seconds.
9. Make sure the monitor still displays an SpO_2 value between 97 and 100% (97 and 102%), or an interference detection message is displayed.
10. Set these alarms on the monitor:
    - Set SpO_2% LO to 90.
    - Set PPR HI to 150.
11. Set PPR on the simulator to 160.
12. Make sure the PPR value on the monitor flashes, and it sounds an alarm.
13. Return PPR on the simulator to 100.
14. Set SpO_2% on the simulator to 80.3% (84%).
15. Make sure the SpO_2% value on the monitor flashes, and it sounds an alarm.
16. Turn the simulator OFF.
17. Make sure the monitor shows a CHECK PROBE message.
18. Disconnect the simulator cable from the Tram module.

NBP Tests

Insert the module in the top slot of a Tram-rac 4 housing or Series 70XX-type.

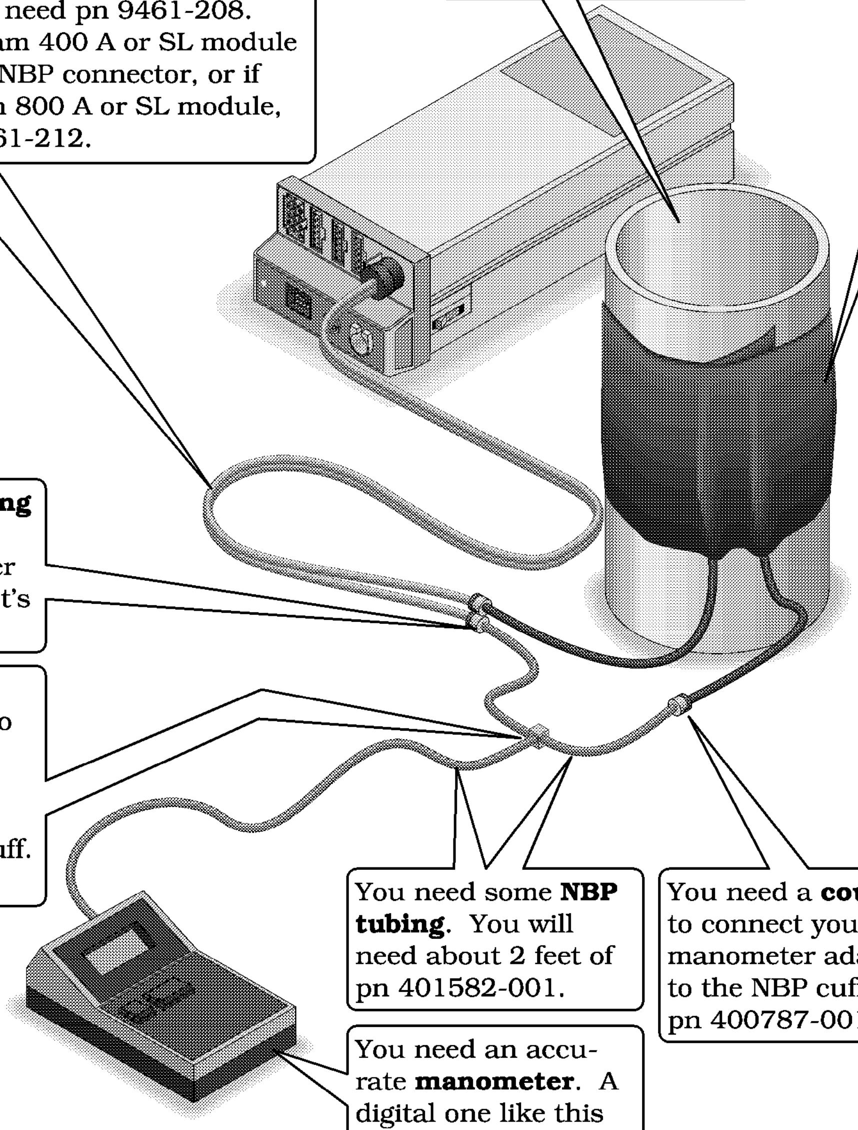


1. Disconnect all parameter cables
2. Apply power to the monitor. If your Tram-rac housing has its own power supply, apply power to it, too.
3. Enure POWER indicator on the Tram module's front panel is turned ON.

There are two different NBP calibration procedures: one for Tram modules used with Tram Critical Care monitors (Tramscope or Solar displays with Tram-rac housings), and one for Tram modules used with Series 70XX-type (7000, 7000RA, 7005, 7010, and 7010RA) monitors.

WARNING
When the NBP cuff is used in this procedure, it must be tightly wrapped around a tube. Never put the cuff around your arm during the calibration procedures. If you do put the cuff around your arm during this procedure, you will injure yourself.

1. Connect a manometer and NBP cuff to the NBP connector on the front of the Tram module as shown below.



You need an **NBP tube**.

- If you have a Tram 100 or 200 module, you need pn 9461-203.
- If you have a Tram 400 module with an NBP connector that protrudes from the front panel, you need pn 9461-208.
- If you have a Tram 400 A or SL module with a recessed NBP connector, or if you have a Tram 800 A or SL module, you need pn 9461-212.

You need a length of **pipe** to wrap the NBP cuff around. You can get this from your local hardware store.

You need an **NBP cuff**. Any size will work. If you don't have one, order pn 9461-301.

You need a **coupling** to connect your manometer adapter to the NBP tube. It's pn 46100-002.

You need a **tee** to connect the hose to the manometer to the hose that connects the NBP hose to the NBP cuff. Use pn 4745-101.

You need some **NBP tubing**. You will need about 2 feet of pn 401582-001.

You need a **coupling** to connect your manometer adapter to the NBP cuff. Use pn 400787-001.

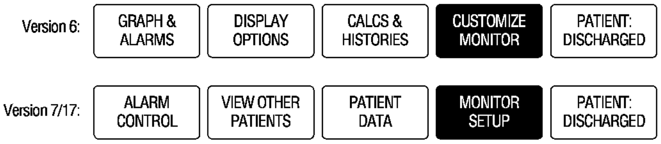
You need an accurate **manometer**. A digital one like this Sensym PDM200M is nice, but you may use a mercury manometer as well.

2. Turn the manometer ON, and set its range switch to the 1000 mmHg setting.

NBP Test for Tram Critical Care Monitors

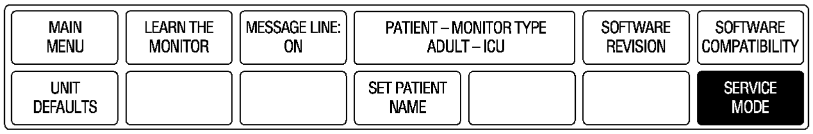
Perform this test if you are using the Tram module with a Tram Critical Care monitor (Tramscope or Solar monitor). This procedure assumes you have either version 6, 7, or 17 software in your Tramscope/Solar display, Tram-rac housing, and Tram module.

1. From the Tramscope display's main menu, rotate the Trim Knob control to highlight CUSTOMIZE MONITOR (with version 6), or MONITOR SETUP (with version 7/17) and then press the Trim Knob control to select it.

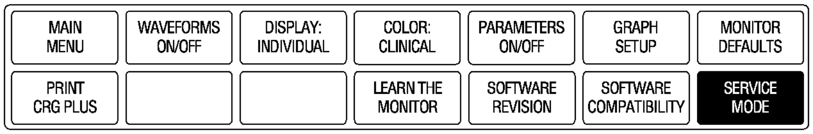

Version 6:
GRAPH & ALARMS
DISPLAY OPTIONS
CALCS & HISTORIES
CUSTOMIZE MONITOR
PATIENT: DISCHARGED
Version 7/17:
ALARM CONTROL
VIEW OTHER PATIENTS
PATIENT DATA
MONITOR SETUP
PATIENT: DISCHARGED

2. Rotate the Trim Knob control to highlight SERVICE MODE, and then press the Trim Knob control to select it.

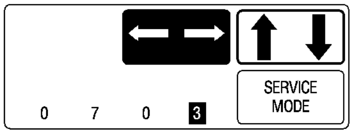
Version 6:


MAIN MENU
LEARN THE MONITOR
MESSAGE LINE: ON
PATIENT – MONITOR TYPE ADULT – ICU
SOFTWARE REVISION
SOFTWARE COMPATIBILITY
UNIT DEFAULTS
SET PATIENT NAME
SERVICE MODE

Version 7/17:


MAIN MENU
WAVEFORMS ON/OFF
DISPLAY: INDIVIDUAL
COLOR: CLINICAL
PARAMETERS ON/OFF
GRAPH SETUP
MONITOR DEFAULTS
PRINT CRG PLUS
LEARN THE MONITOR
SOFTWARE REVISION
SOFTWARE COMPATIBILITY
SERVICE MODE

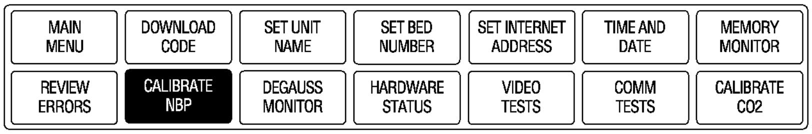
3. You have to enter a password to get into the service mode. The first two digits of the password are the day of the month, and the second two digits are the month. For example, on 7 March, the password would be 0703.
   - Rotate the Trim Knob control to highlight a password digit.
   - Press the Trim Knob control to select the password digit.
   - Rotate the Trim Knob control to change the value of the password digit.
   - Rotate the Trim Knob control to enter the password digit.
   - Repeat the steps above until all of the digits are entered.
   - Rotate the Trim Knob control to hilite SERVICE MODE from the menu.
   - Press the Trim Knob control to enter the service mode.


0 7 0 3
SERVICE MODE

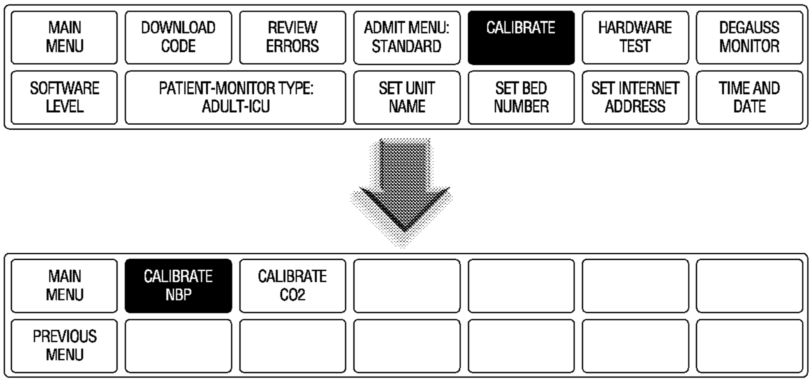
4. If you have version 6 software, rotate the Trim Knob control to highlight CALIBRATE NBP, and then press the Trim Knob control to select it.

   If you have version 7/17 software, rotate the Trim Knob control to highlight CALIBRATE, and press the Trim Knob control to select it. Then rotate the Trim Knob control to highlight CALIBRATE NBP, and press the Trim Knob control to select it.

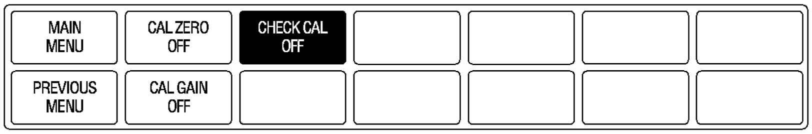
Version 6:


MAIN MENU
DOWNLOAD CODE
SET UNIT NAME
SET BED NUMBER
SET INTERNET ADDRESS
TIME AND DATE
MEMORY MONITOR
REVIEW ERRORS
CALIBRATE NBP
DEGAUSS MONITOR
HARDWARE STATUS
VIDEO TESTS
COMM TESTS
CALIBRATE CO2

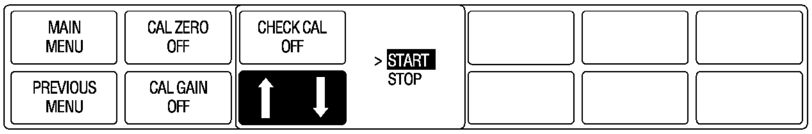
Version 7/17:


MAIN MENU
DOWNLOAD CODE
REVIEW ERRORS
ADMIT MENU: STANDARD
CALIBRATE
HARDWARE TEST
DEGAUSS MONITOR
SOFTWARE LEVEL
PATIENT-MONITOR TYPE: ADULT-ICU
SET UNIT NAME
SET BED NUMBER
SET INTERNET ADDRESS
TIME AND DATE
MAIN MENU
CALIBRATE NBP
CALIBRATE CO2
PREVIOUS MENU

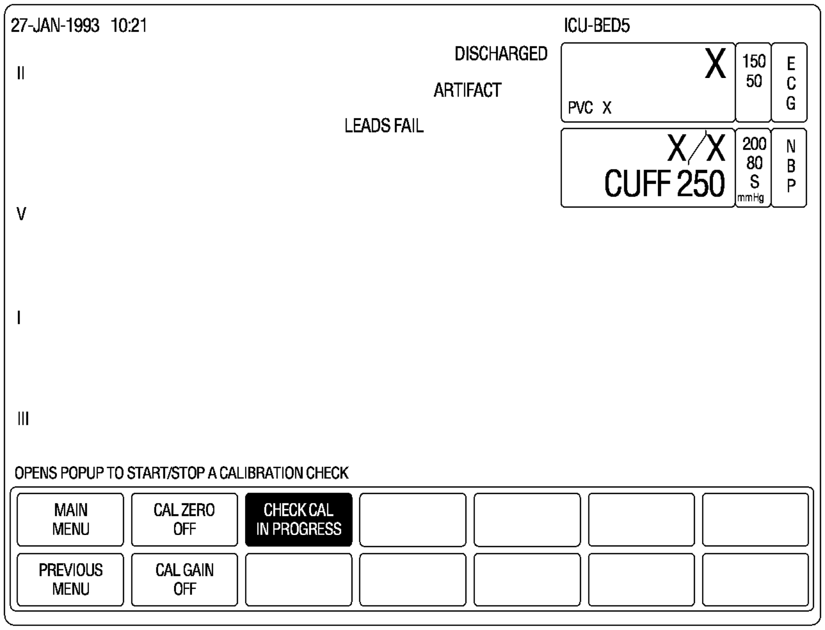
5. Rotate the Trim Knob control to highlight CHECK CAL OFF, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
PREVIOUS MENU
CAL GAIN OFF

6. Rotate the Trim Knob control to highlight START, and then press the Trim Knob control to select it.


MAIN MENU
CAL ZERO OFF
CHECK CAL OFF
> START
STOP
PREVIOUS MENU
CAL GAIN OFF

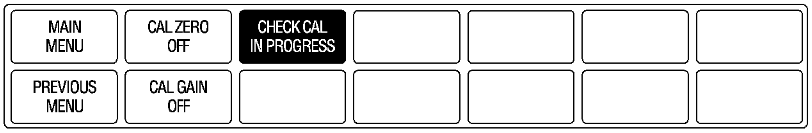
7. The text on the menu item will change from CHECK CAL OFF to CHECK CAL IN PROGRESS. Make sure that the pressure readings (shown as CUFF in the NBP parameter box) on the Tramscope display and manometer are equal (± 1 mmHg) for at least one full minute. If they are not equal, it means that you must calibrate the NBP parameter. Refer to “NBP Calibration” in Chapter 4: “Calibration.”



OPENS POPUP TO START/STOP A CALIBRATION CHECK

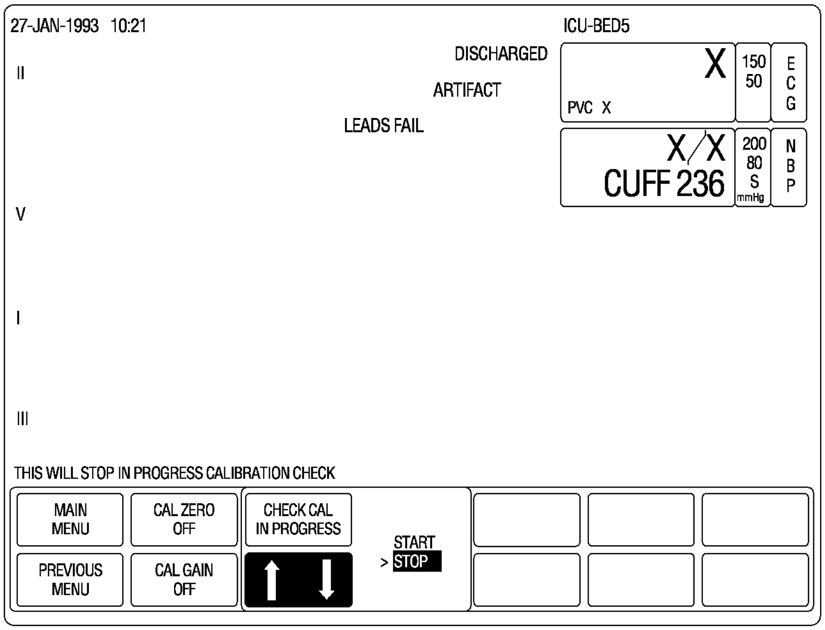
27-JAN-1993 10:21
ICU-BED5
DISCHARGED
ARTIFACT
LEADS FAIL
II
V
I
III
X
PVC X
150
50
E
C
G
X/X
CUFF 250
200
80
S
mmHg
N
B
P
MAIN MENU
CAL ZERO OFF
CHECK CAL IN PROGRESS
PREVIOUS MENU
CAL GAIN OFF

8. Rotate the Trim Knob control to highlight CHECK CAL IN PROGRESS, and then press the Trim Knob control to select it.



MAIN MENU
CAL ZERO OFF
CHECK CAL IN PROGRESS
PREVIOUS MENU
CAL GAIN OFF

9. Rotate the Trim Knob control to highlight STOP, and then press the Trim Knob control to select it. The module then releases pressure in the bulb or cuff.

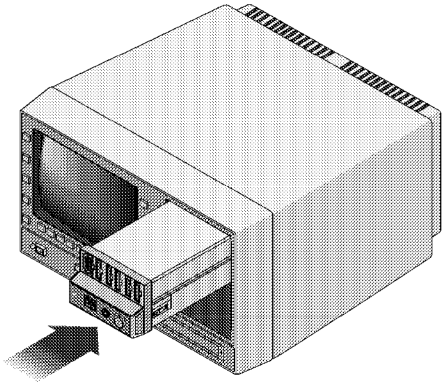

27-JAN-1993 10:21
ICU-BED5
DISCHARGED
ARTIFACT
LEADS FAIL
II
V
I
III
X
PVC X
150
50
ECG
X/X
CUFF 236
200
80
S
mmHg
NBP
MAIN MENU
PREVIOUS MENU
CAL ZERO OFF
CAL GAIN OFF
CHECK CAL IN PROGRESS
START
> STOP

THIS WILL STOP IN PROGRESS CALIBRATION CHECK

This completes the NBP calibration procedure. Remove the cuff and manometer from the Tram module.

NBP Test for Series 70XX Monitors

You should run this test if you use your Tram module with a Series 70XX-type monitor (Series 7000, 7000RA, 7005, 7010, or 7010RA monitors).

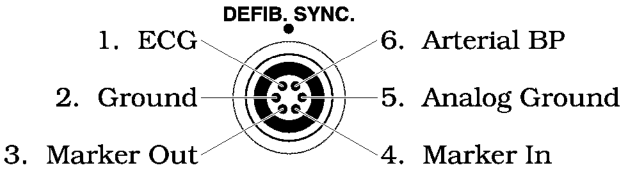


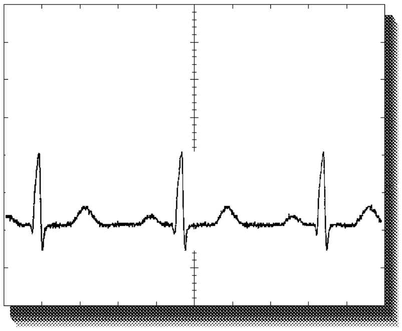
1. Press the SYSTEM key on the monitor.
2. Press the MONITOR SETUP, MONITOR SERVICE, and then CALIBRATE NBP soft keys. Soft keys are the unlabeled keys under the display. The function of each key appears on the display, just above the key.
3. If an NBP cuff is attached to the Tram module, remove it.
4. Press the YES soft key.
5. Press the TEST CAL soft key and verify that the pressure readings on the monitor and manometer are equal (± 1 mmHg) for at least one minute. If they are not equal, it means that you must calibrate NBP (that procedure starts on page 36).
6. Press the TEST CAL soft key to stop the test.
7. Press the CLEAR key.

This completes the NBP calibration procedure. Remove the cuff and manometer from the Tram module.

DEFIB SYNC Test

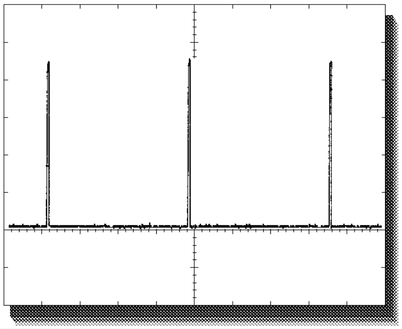
1. Connect an oscilloscope to the DEFIB SYNC connector on the front panel of the Tram module.
2. Test the ECG, Arterial BP, and Marker Out signals from the DEFIB SYNC connector. They should closely resemble the waveforms in the figure below. Note that there are two Marker Out traces shown. The top trace shows the frequency of the pulses; the bottom trace shows the pulse width.

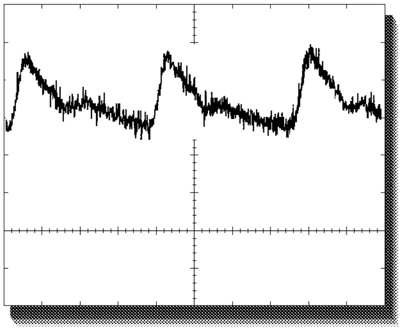




ECG
Signal Pin:1
Ground Pin:5
Probe Type:
x10
Time/
Division:0.2S
Volts/
Division:0.5V

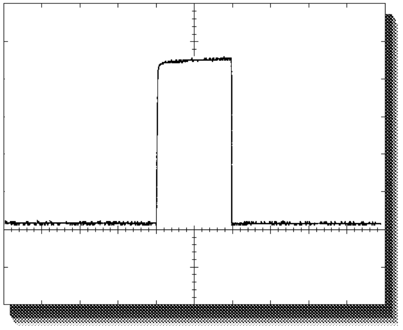
Marker Out
Signal Pin:3
Ground Pin:2
Probe Type:
x10
Time/
Division:0.2S
Volts/
Division:1V



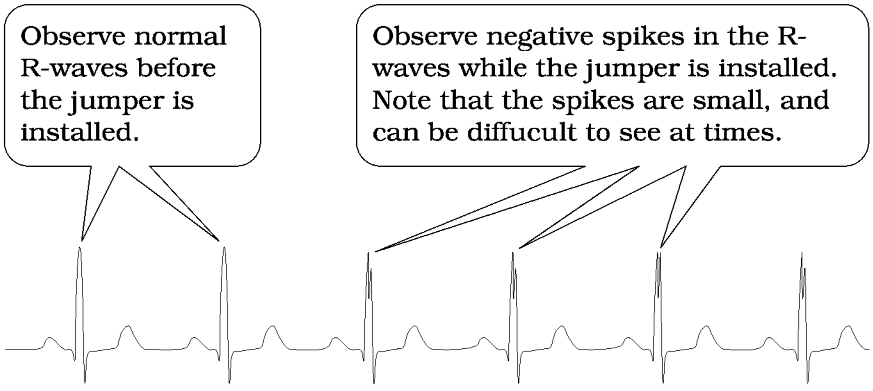


Arterial BP
Signal Pin:6
Ground Pin:5
Probe Type:
x10
Time/
Division:0.2S

Marker Out
Signal Pin:3
Ground Pin:2
Probe Type:
x10
Time/



3. Attach a jumper between pin 3 (Marker Out) and pin 4 (Marker In) of the DEFIB SYNC connector and observe negative spikes in the R-waves of the displayed ECG waveforms.



Observe normal R-waves before the jumper is installed.

Observe negative spikes in the R-waves while the jumper is installed. Note that the spikes are small, and can be diffucult to see at times.

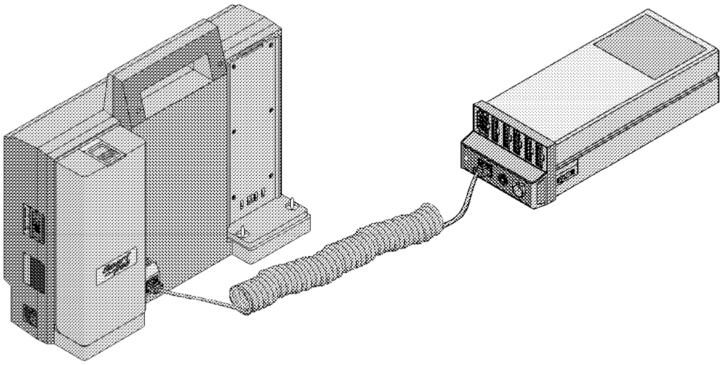
4. Remove the jumper.

Fan Test

Listen for the fan. The fan should be running whenever the Tram module is installed in a bedside monitor.

Transport Test

1. Connect the Tram module to a transport display. Make sure there are batteries on the rear of the display, and that the batteries are sufficiently charged.



2. Remove the Tram module from the bedside monitor.
3. Set up simulator like this:
   - Set heart rate to 80 bpm.
   - Set amplitude to 1.0 mV.
4. Observe the following:
   - No error messages are shown on the transport display.
   - The transport display shows ECG lead II, and it is noise-free.
   - The transport display shows a heart rate of 80 ±1 bpm.
   - If the QRS tones are turned ON, an audible tone sounds with each QRS complex.
5. Make sure that you can display all of the available ECG leads.

Completion

1. Turn all test equipment OFF.
2. Remove all test cabling from the Tram module.

Domestic Electrical Safety Tests

Test Frequency

We recommend electrical safety tests be performed:

- upon receipt of the module,
- every six months thereafter, and
- each time the module is open or repaired.

Remember to record the date and results on the "Maintenance/ Repair Log" included at the end of this chapter.

WARNING
Failure to perform leakage tests may cause undue equipment failure and possible health hazards. Marquette Electronics, Inc does not in any manner, unless an Equipment Maintenance Contract exists, assume the responsibility for performing this recommended safety test. The sole responsibility rests with the individual or institution using the equipment. Marquette service personnel may, at their discretion, use this procedure as a helpful guide during visits to the equipment site.

Required Tests

To help you establish a systematic maintenance routine, Marquette Electronics recommends that you perform all safety tests presented in this chapter

These instructions are intended for every module in the system. If the Tram-rac housing does not have its own power supply, it should remain connected to the monitor during the safety tests. Listed below are the safety tests.

- AC Line Voltage Test; This test verifies that the domestic wall outlet supplying power to the equipment is properly wired.
- Ground Continuity Test; This test verifies continuity between all the exposed metal surfaces of the monitor and the ground prong on the mains AC power cord.
- Hi-Pot Tests; These tests are mandatory when a module is opened or repaired.
- Leakage Current Tests; These tests are performed after the hi-pot tests.

If a module under test fails the leakage tests, do not allow the unit to return to service. Call Tech Support for assistance. (Refer to "How to Reach Us" in Chapter 1: "Introduction."

Test Conditions

All electrical safety test may be performed under normal ambient temperature, humidity, and pressure conditions.

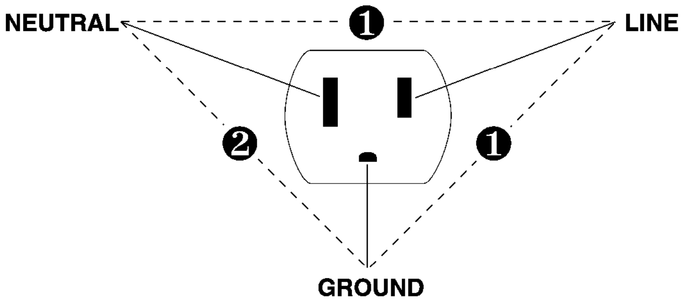
AC Line Voltage Test

This test verifies that the domestic wall outlet supplying power to the equipment is properly wired. For international wiring tests, refer to the internal standards agencies of that particular country.

120 VAC, 50/60 Hz

Use a digital voltmeter to check the voltages of the 120-volt AC wall outlet (dedicated circuit recommended). If the measurements are significantly out of range, have a qualified electrician repair the outlet. The voltage measurements should be as follows:

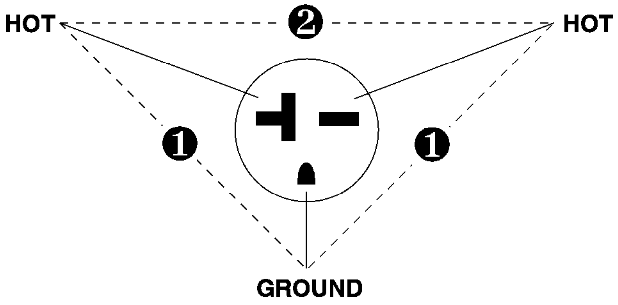
1. 120 VAC (± 10 VAC) between the line contact and neutral and between the line contact and ground.
2. Less than 3 VAC between neutral and ground.



240 VAC, 50/60 Hz

Use a digital voltmeter, set to measure at least 300 VAC, to check the voltages of the NEMA 6-20R, AC wall outlet (dedicated circuit recommended). If the measurements are significantly out of range, have a qualified electrician repair the outlet. The voltage measurements should be as follows:

1. 120 VAC (± 10 VAC) between either “hot” contact and ground.
2. 210 to 230 VAC between the two “hot” contacts.



Ground Continuity Test

This test verifies continuity (less than 100 mΩ resistance) between all the exposed metal surfaces, which have the potential to become energized, and the ground prong on the mains AC power cord. If the metal surfaces are anodized or painted, scrape off a small area in an inconspicuous area for the probe to make contact with the metal.

You will require a digital multimeter (DMM) to check all the metal surfaces of the unit. Make adjustments for any resistance from the test leads.

Do the following steps in the order given.

1. Disconnect each monitor and, if applicable, Tram-rac housing with its own power supply from all power sources. A Tram-rac housing without its own power supply should remain connected to the monitor.
2. Connect the negative lead of the DMM to the ground prong of the power cord plug.
3. Set the DMM to the milli-ohm range.
4. Connect the positive lead of the DMM to any exposed metal surface on the unit under test.
5. The reading should be less than 100 milli-ohms.

   If the readings are not less than 100 milli-ohms, the unit has failed this test.

   - Check for breaks in the power cord or in the internal connections within the monitor.
   - Perform repairs and retest before using the unit on a patient.

Current Leakage Tests

Preparation

The leakage current tests are safety tests to ensure that the equipment poses no electrical health hazards. It is recommended after performing the hi-pot tests.

WARNING
Failure to perform leakage tests may cause undue equipment failure and possible health hazards. Marquette Electronics, Inc does not in any manner, unless an Equipment Maintenance Contract exists, assume the responsibility for performing this recommended safety test. The sole responsibility rests with the individual or institution using the equipment.

Required Tools/ Equipment

You will need the special tools and items listed below. Equivalent equipment may be substituted if necessary.

Table 5-8. Required Tools/Equipment

Item	Manufacturer	Part Number
Leakage current tester 120 V (or equivalent) 240 V (or equivalent)	MEI	 MT-1216-01 MT-1216-02
Digital multimeter (DMM)	Fluke	8060A
ECG test body	MEI	97516-100
SpO_2	MEI	MT-4366

NOTE
The accuracy of the leakage tests depends on a properly-wired wall outlet. Do not proceed until you verify the integrity of the power source.

Current Limits

Use the table below to determine the maximum allowable leakage currents. For international leakage limits, refer to the internal standards agencies of that particular country.

Table 5-9. Maximum Allowable Leakage Currents

	Test	Maximum Current
1	Patient-Cable-Leakage-to-Ground Ground closed, normal & reverse polarity	10 µA for 120 V 10 µA for 240 V
2	Patient-Cable-Leakage-into-Patient Leads Ground closed, normal & reverse polarity	10 µA for 120 V 50 µA for 240 V

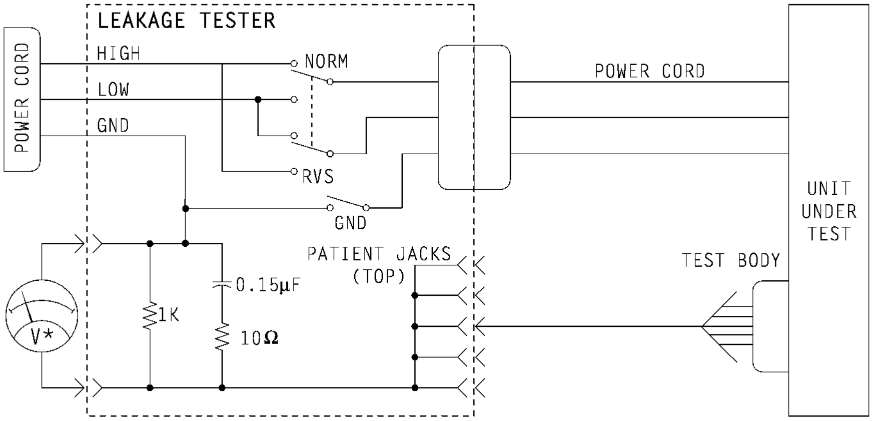
Patient-Cable-Leakage to-Ground Test

This test checks leakage current from the patient cable connector of the module to ground.

1. Install the module in a a Tram-rac 4 housing or Series 70XX-type monitor.
2. Connect the monitor power cord to the power outlet on the leakage tester.
3. With the power switch of the leakage tester off, connect the power cord of the leakage tester to a correctly wired and properly grounded ac power outlet.
4. Set leakage tester switches as follows:
    a. Set the selector knob to 3.
    b. Set the GND switch to GND OPEN.
    c. Set the polarity switch to NORM.
    d. Set the power switch to OFF.
5. Connect an appropriate test body to the connector of the module.
6. Connect a short length of cable between the test body installed in the last step and the jacks on the top of the leakage tester.
7. Set the leakage tester's power switch to ON.
8. Set the monitor's rear panel power switch to ON.
9. Read the leakage current indicated on the DMM.

If the reading is greater than 10 microamperes (10 millivolts on the DMM), the module fails this test and should be repaired and tested again.

Partial Schematic Diagram



1-mV meter reading = 1-µA leakage current

10. Change the leakage tester polarity switch to the RVS position.
11. Read the leakage current indicated on the DMM.

    If the reading is greater than 10 microamperes (10 millivolts on the DMM), your module fails this test and should be repaired and tested again.

12. Change the GND switch to the CLOSED position.
13. Read the leakage current indicated on the DMM.

    If the reading is greater than 10 microamperes (10 millivolts on the DMM), your module fails this test and should be repaired and tested again.

14. Change the leakage tester polarity switch to the RVS position.
15. Read the leakage current indicated on the DMM.

    If the reading is greater than 10 microamperes (10 millivolts on the DMM), your module fails this test and should be repaired and tested again.

16. For Tram X50 modules, repeat steps 4 through 15 with the SpO_2 test body int he blue SpO_2 connector.
17. Set the power switch of the leakage tester to OFF.

Patient-Cable-Leakage-into-Patient Leads Test

This tests the patient cable leakage current from a 115 or 220V AC source into the connector of the module.

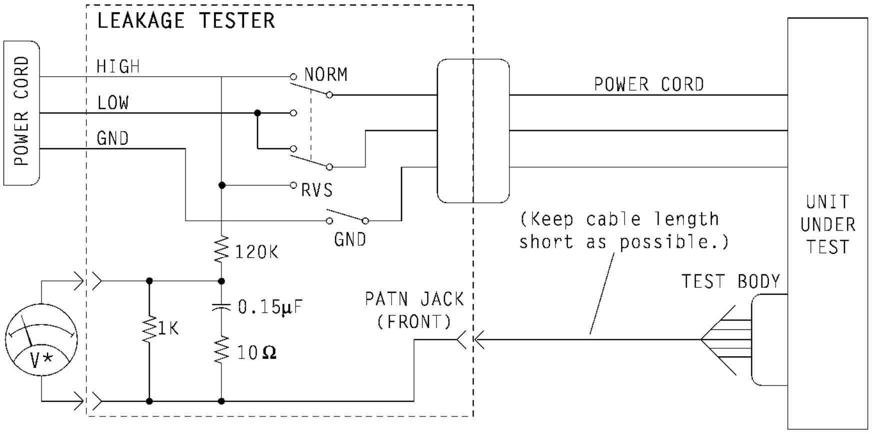
1. Set the leakage tester switches like this:
   a. Set the selector knob to 5.
   b. Leave the GND switch set to CLOSED.
   c. Set the polarity switch to NORM.
2. Disconnect the cable between the leakage tester and the test body, and reconnect it between the test body and the PATN JACK connector on the front panel of the leakage tester.

WARNING
The following step will cause high voltage to appear at the PATN JACK on the leakage tester.

3. Set power switch on the leakage tester to ON.
4. Read leakage current indicated on DMM.
   - For 115 V/60 Hz power: 10 microamperes (10 millivolts on the DMM)
   - For 220 V/50 Hz power: 50 microamperes (50 millivolts on the DMM)

   If your module fails this test, it should be repaired and tested again.

Partial Schematic Diagram


LEAKAGE TESTER
POWER CORD
HIGH
LOW
GND
NORM
RVS
GND
120K
0.15µF
1K
10Ω
V*
PATN JACK
(FRONT)
POWER CORD
(Keep cable length short as possible.)
TEST BODY
UNIT UNDER TEST

1-mV meter reading = 1-µA leakage current

5. Change the leakage tester polarity switch to the RVS position.
6. Read the leakage current indicated on the DMM.

   If the reading is greater than the following, your module fails this test and should be repaired and tested again.

   - For 115 V/60 Hz power: 10 microamperes (10 millivolts on the DMM)
   - For 220 V/50 Hz power: 50 microamperes (50 millivolts on the DMM)
7. For Tram X50 modules, repeat steps 1 through 6 with the SpO_2 test body int he blue SpO_2 connector.

Completion

1. Set the power switch on the leakage tester to OFF and disconnect all test equipment from the module.
2. Disconnect the monitor power cord from leakage tester.
3. Disconnect the tester from the power outlet.

Hi-Pot Tests

Preparation

Hi-pot (high-potential) tests protect the patient from possible electrical health hazards. They are recommended for any patient-connected devices that are repaired to ensure patient isolation after the repair.

Test Frequency

This test is required each time a module is opened or repaired.

WARNING
Failure to perform hi-pot tests may cause undue equipment failure and possible health hazards. Marquette Electronics, Inc does not in any manner, unless an Equipment Maintenance Contract exists, assume the responsibility for performing this recommended safety test. The sole responsibility rests with the individual or institution using the equipment.

Required Tools/ Equipment

Equipment required to perform the test is listed below. Equivalent equipment may be substituted if necessary.

Table 5-10. Required Tools/Equipment

Item	Manufacturer	Part Number
AC/DC hi-pot generator	Hipotronics	AD125
ECG test body	MEI	97516-100
Hi-pot cable	MEI	97516-101
Bendix connector (used to make test connector)	MEI	1866-030

Generator Setup

Follow these steps in the same order in which they are listed.

1. Set up the AC/DC hi-pot generator:
   a. Turn the power switch to ON.
   b. Set the VOLTAGE RANGE selector to MEDIUM.
   c. Set the RAISE VOLTAGE selector to 0 volts.
   d. Set the OUTPUT & CURRENT selector to the 5 mA range.
   e. Allow the unit to warm up for 15 minutes before proceeding with this test.
2. If the module to be tested is installed in a monitor, remove it from the monitor.

Ground Connection

Connect all of the ground pins at the rear panel connector on the module to the GROUND of the AC/DC hi-pot generator using the hi-pot cable.

1. A grounding test connector must be made to connect all pins at the rear connector of the module together. Use test connector, pn 1886-030, to fabricate a grounding test connector.
2. Securely attach ground clip from AC/DC Hi-Pt Generator to grounding test connector.

High Voltage Connection

The module parameter determines the test body used. Install ECG test body to connector at the front of the module.

AC Hi-Pot Test

Perform this test on the ECG input of the Tram module. Never attempt to perform this test on any of the other connectors.

WARNING
Never attempt to perform this test on any of the other connectors.

1. Install the ECG test body into the connector of the module.
2. Connect one end of a high voltage lead to the exposed lead of the test body.
3. Connect the other end of the high voltage lead to the AC OUT connector of the AC/DC hi-pot generator.

WARNING
In the following step, high voltage appears at the test body.

4. Set the HIGH VOLTAGE switch to ON. The high voltage indicator light should illuminate.

WARNING
During test, watch that the analog meter to ensure current never exceeds 1 mA. If it does, the unit has failed the test.

5. Slowly turn the RAISE VOLTAGE selector to 3000 volts.
6. Wait for 10 seconds. If the breakdown warning lamp or buzzer activate before the time expires, then the unit has failed the test.
7. Slowly turn the RAISE VOLTAGE selector to 0 volts.
8. Set the HIGH VOLTAGE switch to OFF. The high voltage indicator should turn off.
9. If your module fails this test, make the necessary repairs and test it again.
10. Perform the DC hi-pot test.

DC Hi-Pot Test

The following procedure should only be performed on the ECG connector. Follow these steps in the order listed.

1. Set the AC/DC hi-pot generator OUTPUT & CURRENT selector to the x 100 DC range.
2. Remove the high voltage lead from the AC OUT connector and connect it to DC OUT connector.

WARNING
In the following step, high voltage appears at the test body.

3. Set the HIGH VOLTAGE switch to ON. The high voltage indicator should glow.
4. Slowly turn the RAISE VOLTAGE selector to 6000V dc.
5. Wait for 1 second. If the breakdown warning lamp or buzzer activates before the time expires, then the unit has failed the test.
6. Slowly turn the RAISE VOLTAGE selector to 0 volts.
7. Set the HIGH VOLTAGE switch to OFF. The high voltage indicator should turn off.
8. If your Tram module passed the test, disconnect all cables and perform the Current Leakage Tests, listed earlier in this chapter.
9. If your Tram module failed the test, make the necessary repairs and test it again.

Repair Log/PM Inspection Form

Unit Serial Number:

Institution Name:

Date	Maintenance/Repair	Technician

Tram 100 - 850 A/SL Modules

MPMFRM-002D
31 JUL 1995

Preventive Maintenance Inspection Form

(See Service Manual p/n 404422-001 Tram 100 - 600, p/n 404422-065 Tram 100 - 850 A and SL for Details)

Customer ______________________ Customer Number ______________ Date __________

FE ____________________ FE ID _______ Call Number ______________________________

Equipment Serial Number ______________ Software Revision ______________________

Module Type

☐ Tram 100	☐ Tram 200	☐ Tram 250
☐ Tram 300	☐ Tram 400	☐ Tram 450
☐ Tram 500	☐ Tram 600	☐ Tram 650
☐ Tram 800	☐ Tram 850	
☐ "A" Series	☐ "SL" Series	

Tools Required

Leakage tester	Multimeter	Oscilloscope
CO simulator II	Marq1 simulator	Manometer
NIBP cuff	SpO$_2$ simulator	Nicolay adapter cables
Standard hand tools	Anti-static mat and strap	

Visual Inspection

Inspect the following for excess wear and /or any visual signs of damage

☐ General	☐ Latches	☐ Connectors
☐ Cable insulation	☐ Reseat socketed components / connectors	

Calibration

☐ NIBP

Electrical Safety Tests

☐ Customer will perform Electrical Safety tests

		Open		Closed	
		Normal	Reversed	Normal	Reversed
ECG	Patient Source Risk leakage (<10µA)	____µA	____µA	____µA	____µA
	Patient Sink Risk leakage (<10µA without patient cable)	N/A	N/A	____µA	____µA
SpO$_2$ (for X50 series modules only)	Patient Source Risk leakage (<10µA)	____µA	____µA	____µA	____µA
	Patient Sink Risk leakage (<10µA without patient cable)	N/A	N/A	____µA	____µA

Checkout Procedure

ECG

☐ Rate (±1)	☐ All leads noise free	☐ Pace
☐ Leads fail	☐ Amplitude	☐ 3 Lead(A and SL Series)

RESP Base line of 750Ω - ΔR 0.5Ω - 30 breaths per minute

☐ Rate lead II (± 2)	☐ Noise free lead II
☐ Rate lead I (± 2)	☐ Noise free lead I

BP (2% or ±1mmHg whichever is greater)

☐ Static BP1	☐ Dynamic BP1	☐ Noise free BP1
☐ Static BP2	☐ Dynamic BP2	☐ Noise free BP2
☐ Static BP3	☐ Dynamic BP3	☐ Noise free BP3
☐ Static BP4	☐ Dynamic BP4	☐ Noise free BP4

Tram 100 - 850 A/SL Modules

MPMFRM-002D
Page 2

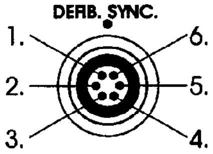
Checkout Procedure Cont.

TEMP / CO The temperature tolerance for all Tram 100-850 A and SL Series modules is ±0.1°C. Tolerances for Tram 100-600 modules are specified below.
[☐ T1 ⟷ ☐ T2] (YSI 400, 1% or ±0.3°C whichever is greater)
☐ BT range (± 0.2°C) ☐ IT range (± 0.3°C)

SpO_2 ☐ %SpO_2 range (90 - 100, 2.5%), (80 - 89.9, 3.1%), (60 - 79.9, 3.4%)
☐ PPR range (2.7%) ☐ Noise

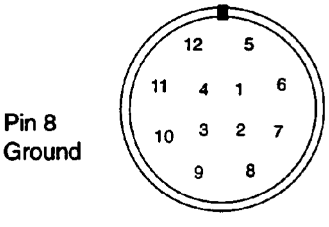
NIBP ☐ Pump (Inflate an Adult Cuff with the bladder folded in half in <30 Sec.)
☐ Leak (<1mmHg per 4 Sec.) ☐ Static (±1 mmHg)

Analog Output Use Pin 2 for Marker Out ground and Pin 5 for Analog ground

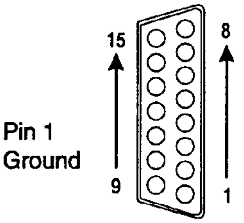


☐ Pin 1 ECG ☐ Pin 6 Arterial BP ☐ Pin 3 Defib Sync
☐ Marker In (Short Pin 3 to Pin 4 Look for negative pulse on the R wave.)

To test Analog Output from the rear connector of a Tram 100 - 800 module check the following waveforms at a Tram RAC.



Rac 3 / Rac 4



Rac 4A

☐ ECG II	Pin 1	Pin 9
☐ Trace 1	Pin 2	Pin 2
☐ ECG V	Pin 3	Pin 10
☐ ART (or BP1)	Pin 4	Pin 5
☐ BP 2 (or SpO_2 Wave)	Pin 5	Pin 13
☐ BP 3 (or SpO_2 Value)	Pin 6	Pin 3
☐ BP 4 (or Resp)	Pin 7	Pin 11

General ☐ Transport test ☐ No LCD error messages
☐ Fan

Comments

Please comment on any other environmental conditions (Static, Temperature, AC Power, Etc..) that may affect operation or reliability.

Briefly describe all repairs / adjustments made and list all parts replaced.

Customer Signature ______________________ FE Signature ______________________

Marquette Electronics, Inc Service and Supplies Division Jupiter,FL 33468-9100

6 CONNECTIONS

External Connectors 6-2
- Blood Pressure Connector 6-2
- DEFIB SYNC Signals 6-3
- Display Connector 6-4
- ECG/RESP Connector 6-5
- Rear Connector 6-5
- MEI/Nellcor SpO_2 Connector 6-7
- Ohmeda SpO_2 Connector 6-8
- TEMP/CO Connector 6-9

External Connectors

Pin-by-pin descriptions and the signal names for each connector on the front panel and rear of the module are described in this section. Each module uses a “bristle brush” connector to interface to the backplane of the Tram-rac 4 housing or Series 70XX-type monitor (Series 7000, 7000RA, 7005, 7010, or 7010RA) monitor.

Blood Pressure Connector

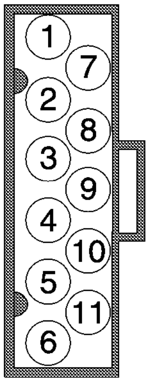
Invasive blood pressure transducers connect to the Tram modules at the BP connectors. The BP connectors are all functionally the same, so the following information applies to all Tram module BP connectors.

If you want to use your existing blood pressure cables and transducers with the Tram modules, but they use different connectors, we offer these termination kits:

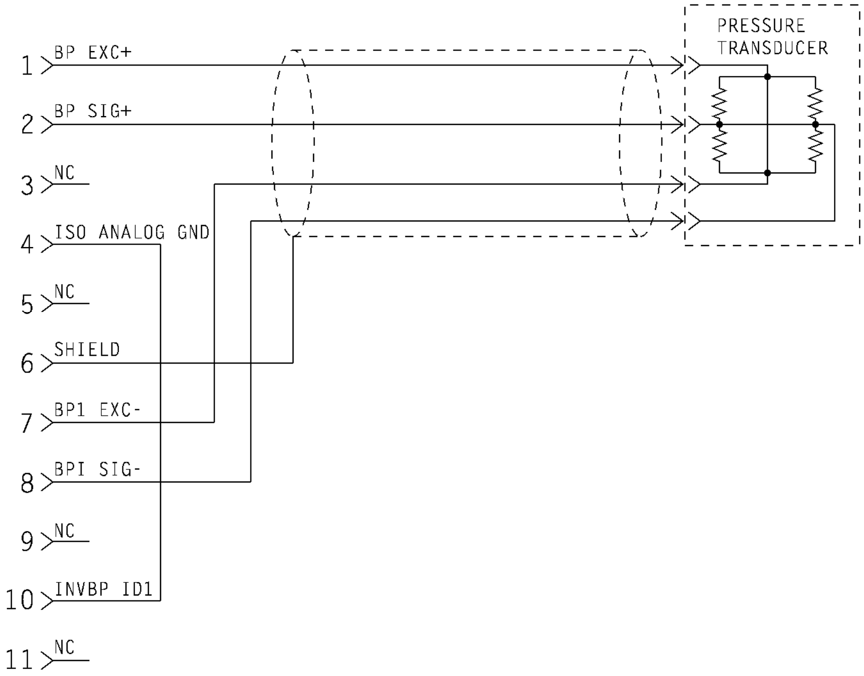
- Abbott Transpac II cables use pn 700074-001
- Abbott Transpac III cables use pn 700075-001
- American Edwards cables use pn 700076-001
- Spectramed cables use pn 700077-001
- Utah cables use pn 700078-002

Tram X00 Modules/Eagle Monitor Termination Instructions for BP, CO, and TEMP Cables, pn 403799-016, describes how to terminate these cables.

Table 6-1. BP Front Connector

Pin	Name	Type	
1	BP_EXC+	Positive excitation voltage (output)	
2	BP_SIGNAL+	Positive analog pressure signal from transducer	
3	NC		
4	ISO_ANALOG_GND	Isolated analog ground reference	
5	NC		
6	SHIELD	Cable shield	
7	BP_EXC–	Negative excitation voltage (output)	
8	BP_SIG–	Negative analog pressure signal from transducer	
9	NC		
10	INVBP_ID	When you connect this pin to ISO ANALOG GND (pin 4), the monitor show the BP trace for this connector	**Front View of Red-Colored BP Connector**
11	NC		

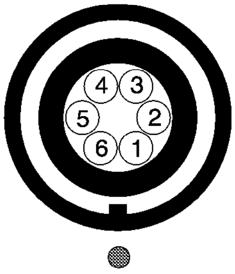
The schematic diagram of the blood pressure probe sensor is presented below.



DEFIB SYNC Signals

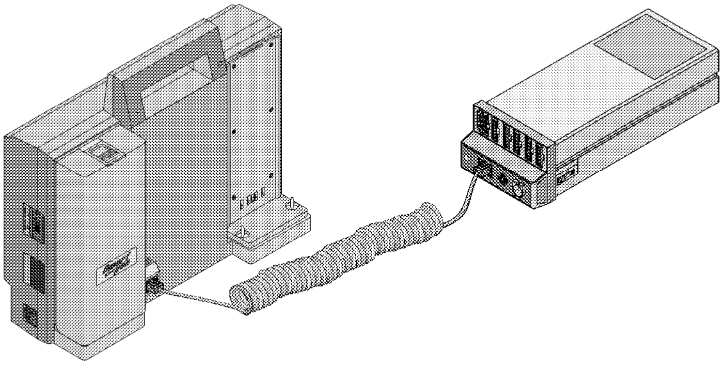
The DEFIB SYNC connector carries signals for interfacing with a defibrillator. It also has analog output signals for ECG traces. If you need to connect a defibrillator with the module, a 15-foot defibrillator cable, pn 403936-001, is available. It has a DEFIB SYNC connector on one end and it is unterminated at the other end.

Table 6-2. DEFIG SYNC Connector

Pin	Name	Description	
1	ECG	An ECG x1000 analog output for the top displayed ECG trace	 **Front View of Module**
2	GND	Digital ground reference for MARKER IN and MARKER OUT	
3	MARKER_OUT	This normally low output goes positive on the ECG R wave. It is used by some defibrillators to avoid firing during the T-wave. Jumpers on the module processor PCB, pn 800210, select the amplitude (5V or 15V) and pulse width (10 mS or 100 mS) are selectable by the software available in the host monitor menu. See Chapter 4: “Calibration” for details.	
4	MARKER_IN	On positive edges of this input, the monitor and DDW display a marker on the ECG waveform. It is usually used to record the time of defibrillation.	
5	ANALOG_GND	Analog ground reference for the ECG and BP outputs.	
6	BP	A 10mV/mm Hg blood pressure analog output for the top ART trace. If there is no ART trace, it is for the BP1 trace. If the signal is not zeroed, this pin outputs a 60-Hz, 1 Vp-p triangle wave.	

Display Connector

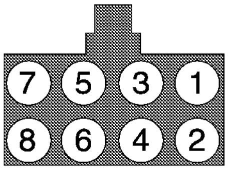
The DISPLAY connector carries communication and power signals between the Tram module and a transport display. Note that the Tram module must be connected to the connector on the rear of the transport display. If you plug it into one of the side connectors, a large COMMUNICATION FAILURE message will appear.



You can use any of these cables to connect your Tram module to a transport display:

Table 6-3. Display Cables		
Part Number	**Length (Feet)**	**Length (Meters)**
403495-001	10	3
403496-001	15	4.6
406468-002	25	7.6
406468-001	40	12.2

Table 6-4. ECG/RESP Connector

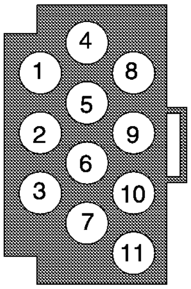
Pin	**Name**	**Description**	
1	DLK_TXD+	RS422 output[1]	 **Front View of Module**
2	DLK_TXD–	RS422 output[1]	
3	DLK_RXD+	RS422 input[1]	
4	DLK_RXD–	RS422 input[1]	
5	PWRRTN	Power Bus and +16.5V ground	
6	SENSE_OUT	The transport display connects this signal to PWRRTN to turn the Tram module on.	
7	+16.5V	A 16.5-volt output that powers the transport display when you install the Tram module in a monitor.	
8	PWRBUS	A 10 to 16.75-volt power input from the transport display.	

[1] NOTE: 38.4k b/s, 8 bit, no parity, 1 stop bit.

ECG/RESP Connector

ECG patient cables attach to the ECG/RESP connector. In addition to the ECG leadwire, the signals on this connector include a 52.6-kHz respiration carrier.

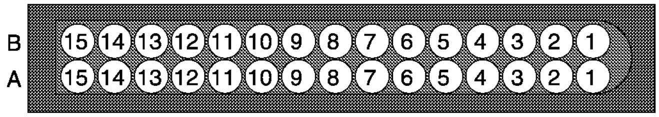
Table 6-5. ECG/RESP Connector

Pin	Name	Description	
1	RA	Right arm limb leadwire	 **Front View of Green-Colored ECG Connector**
2	V2	V2 chest leadwire	
3	V3	V3 chest leadwire	
4	LA	Left arm limb leadwire	
5	RL	Right leg limb leadwire	
6	V/V1	V (during 3 or 5-leadwire use) or V1 (during 10-leadwire use) for chest leadwire	
7	V4	V4 chest leadwire	
8	LL	Left leg limb leadwire	
9	V6	V6 chest leadwire	
10	V5	V5 chest leadwire	
11	SHIELD	Cable shield	

Rear Connector

Series 7XXX monitors and Tram-rac housings connect to the Tram module at the MONITOR connector. This is the only connector on the Tram module's rear panel. The MONITOR connector carries power, communication, and analog output signals between the Tram module and a monitor.

Table 6-6. Rear Module Connector



Rear View of Module

Pin	Name	Description
A1	AGND	Non-isolated analog ground reference
A2	XMIT_EN*	When installed in a Tram-rac housing, the Tram module asserts this CMOS output signal to enable Tram-net communication drivers in the Tram-rac housing. When installed in a Series 7XXX monitor, the Tram module asserts this signal whenever the monitor asserts MOD_ENABLE (on pin 2B) high.
A3	SYNC_ECG_RTN	Ground reference for SYNC ECG on pin 4A.
A4	SYNC_ECG	ECG x10 analog output for the top displayed ECG trace[1]
A5	MOD DATA CLK*	Clock input for synchronous shift register communications with a Series 7XXX monitor. Toggles to clock data to a monitor (across MOD DATA OUT) or from a monitor (across MOD DATA IN). This signal toggles 32 times and then goes high to disable Tram module communications while reading from other modules.
A6	MOD_LOAD_DATA_IN*	Module data input. A CMOS signal used with synchronous shift register communication from Series 7XXX monitor, and with Tram-net communication from Tram-rac housings.
A7	MOD_DATA_OUT*	Module data output. A CMOS signal used with synchronous shift register communication to Series 7XXX monitor, and with Tram-net communication to Tram-rac housings.

Table 6-6. Rear Module Connector

A8	MOD_DATA_LCH*	Synchronous shift register communication latch input from Series 70XX monitor. Goes high to signal to the module that it should latch onto the last 32 bits of data sent across MOD DATA IN.
A9	BP3	10 mV/mmHg analog output for BP3 blood pressure trace; outputs SpO_2 value x 10 mV if BP3 isn't cabled; outputs buzz[1] if BP3 is not zeroed
A10	NC	
A11	GND	Non-isolated digital ground reference
A12	BKPLANE_ID	A +5-volt input, supplied only by Tram-rac housings with Tram-net communications.
A13	NC	
A14	NC	
A15	AGND	Non-isolated analog ground reference
B1	ART_BP	10 mV/mmHg analog output for top ART blood pressure trace; outputs BP1 trace if no ART trace is displayed; outputs buzz† if ART/BP1 is not zeroed.
B2	MOD_ENABLE	An input that the 70XX monitor asserts to enable synchronous serial shift register communication with the Tram module.
B3	BP2	10 mV/mmHg analog output for BP2 blood pressure trace; outputs SpO_2 trace if BP2 is not cabled; outputs buzz[1] if BP2 is not zeroed
B4	+16.5V	A 16.5-volt input that powers the Tram module (and, if connected, the transport display)
B5	PWRBUS	16.75-volt power input
B6	TRC2/ECGI	ECG x1000 analog output for lead II. If lead II fails, this signal reverts to buzz[1]
B7	TRC1/ECGI	ECG x1000 analog output for the top displayed ECG trace. This signal reverts to buzz[1] during leads fail condition
B8	ECGV	ECG x1000 analog output for lead V. If lead V fails, this signal reverts to buzz[1]
B9	NC	
B10	BP4	10mV/mmHg analog output for BP4 blood pressure trace; outputs RESP waveform (without markers) if BP4 is not cabled; outputs buzz[1] if BP4 is not zeroed
B11	GND	Non-isolated digital ground reference
B12	+5V	A +5-volt input, used to determine that the Tram module is installed in a monitor.
B13	NC	
B14	NC	
B15	AGND	Non-isolated analog ground reference

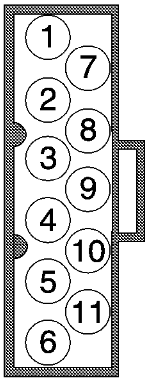
[1] NOTE: Buzz is a 60-Hz, 1-volt peak-to-peak triangle waveform centered around 0 volts. It is not perfectly shaped and only indicates the trace is in a failed condition.

MEI/Nellcor SpO_2 Connector

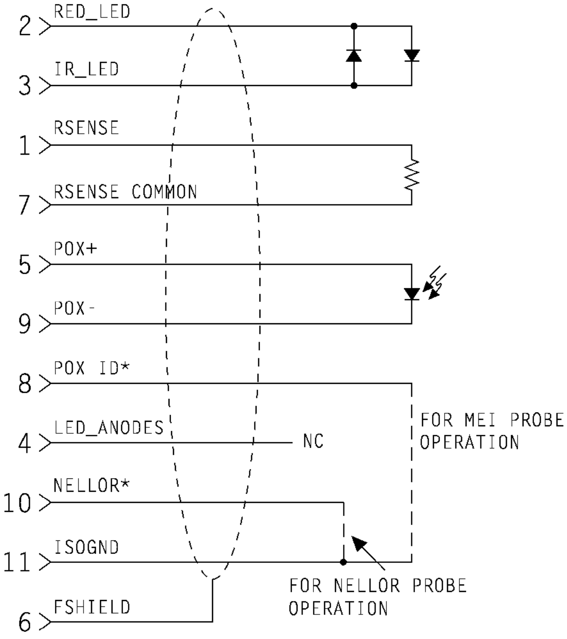
There are two different types of connectors used for collection of SpO_2 data.

Nellcor-style and MEI, non-invasive pulse oximetry probes connect to the Tram X50 module with the square-style SpO_2 connector. This connector carries the red and infrared light source drive outputs and the photodetector and probe type inputs.

Table 6-7. SpO_2 Connector

Pin	Name	Description	
1	RSENSE	Probe characteristics ID resistor measurement	 1 7 2 8 3 9 4 10 5 11 6 **Front View Blue-Colored SpO_2 Connector**
2	RED_LED	Red LED cathode (RED LED source)	
3	IR_LED	Infrared light source cathode (Infrared LED source)	
4	LED_ANODES	NC	
5	POX+	Photodetector anode	
6	FSHIELD	Cable shield	
7	RSENSE COMMON	Common return for RSENSE signal	
8	POX_ID*	Tied to ISOGND for MEI probe identification	
9	POX–	Photodetector cathode	
10	NELLCOR*	Tied to ISOGND for Nellcor probe identification	
11	ISOGND	Ground reference for PRB_SENSE and NELLCOR* signals	

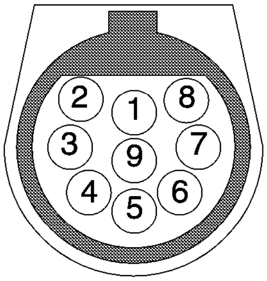
The schematic diagram of the MEI/Nellcor probe sensor is presented below.


2 RED_LED
3 IR_LED
1 RSENSE
7 RSENSE COMMON
5 POX+
9 POX-
8 POX ID*
4 LED_ANODES
NC
FOR MEI PROBE OPERATION
10 NELLOR*
11 ISOGND
FOR NELLOR PROBE OPERATION
6 FSHIELD

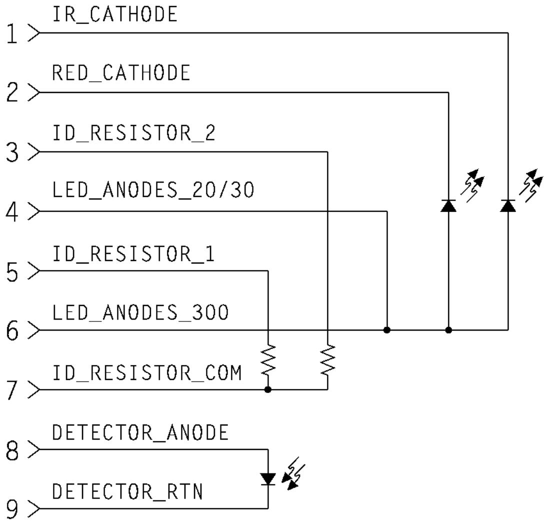
Ohmeda SpO_2 Connector

Ohmeda-style, non-invasive pulse oximetry probes connect to the Tram X50 modules with the round-style SpO2 connector. This connector carries the red and infrared light source drive outputs and the photodetector and probe type inputs.

Table 6-8. SpO_2 Connector

Pin	Name	Description	
1	IR_CATHODE	Infrared light source cathode. A 5-volt output, with a 33% duty cycle at 400 Hz for 50-Hz power, or at 480 Hz for 60-Hz power.	 **Front View** **White-Colored** **SpO_2 Conductor**
2	RED_CATHODE	Red light source cathode. A 5-volt output, with a 33% duty cycle at 400 Hz for 50-Hz power, or at 480 Hz for 60-Hz power.	
3	ID_RESISTOR_2	Probe type identification resistor 2	
4	LED_ANODE_20/30	Light source anode for type 20 and 30 probes. Used as a return for IR_CATHODE and RED CATHODE.	
5	ID_RESISTOR_1	Probe type identification resistor 1	
6	LED_ANODES_300	Light source anode for type 300 probes. Used as a return for IR_CATHODE and RED CATHODE.	
7	ID_RESISTOR_COM	Probe type identification resistor common	
8	DETECTOR_ANODE	Photodetector anode	
9	DETECTOR_RTN	Photodetector cathode	

The schematic diagram of the Ohmeda probe sensor is presented below.

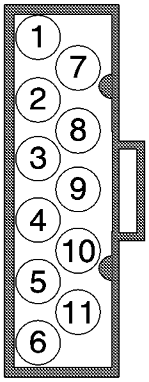

1
IR_CATHODE
2
RED_CATHODE
3
ID_RESISTOR_2
4
LED_ANODES_20/30
5
ID_RESISTOR_1
6
LED_ANODES_300
7
ID_RESISTOR_COM
8
DETECTOR_ANODE
9
DETECTOR_RTN

TEMP/CO Connector

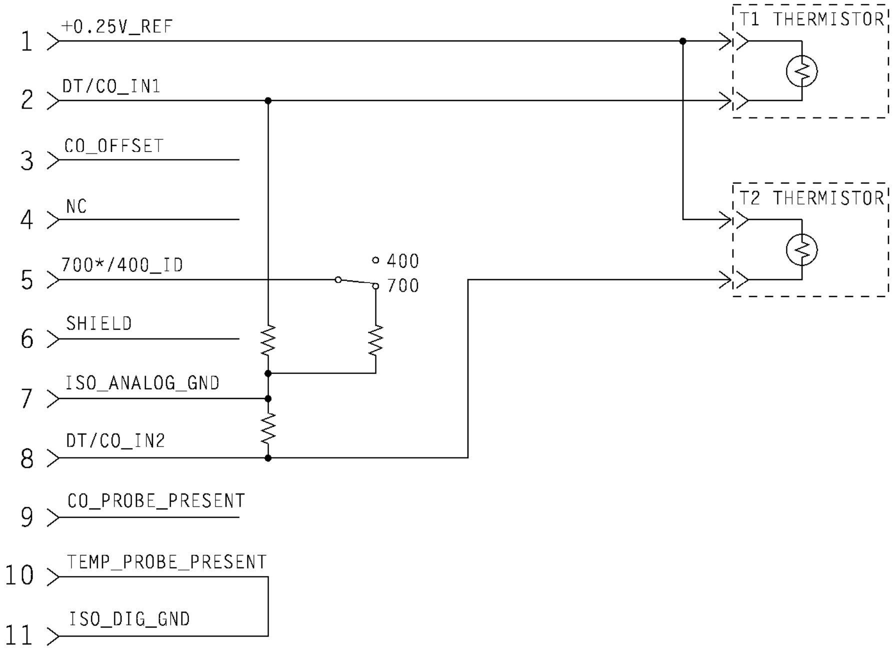
Thermistors and cardiac output probes connect to the Tram module at the TEMP/CO connector.

If you have existing temperature or cardiac output cables, we offer termination kits so you can use the cables with your Tram module. Terminate existing cardiac output cables with pn 404859-004. Terminate existing temperature cables with pn 404859-003. Tram X00 Modules/Eagle Monitor Termination Instructions for BP, CO, and TEMP Cables, pn 403799-016, describes how to terminate these cables.

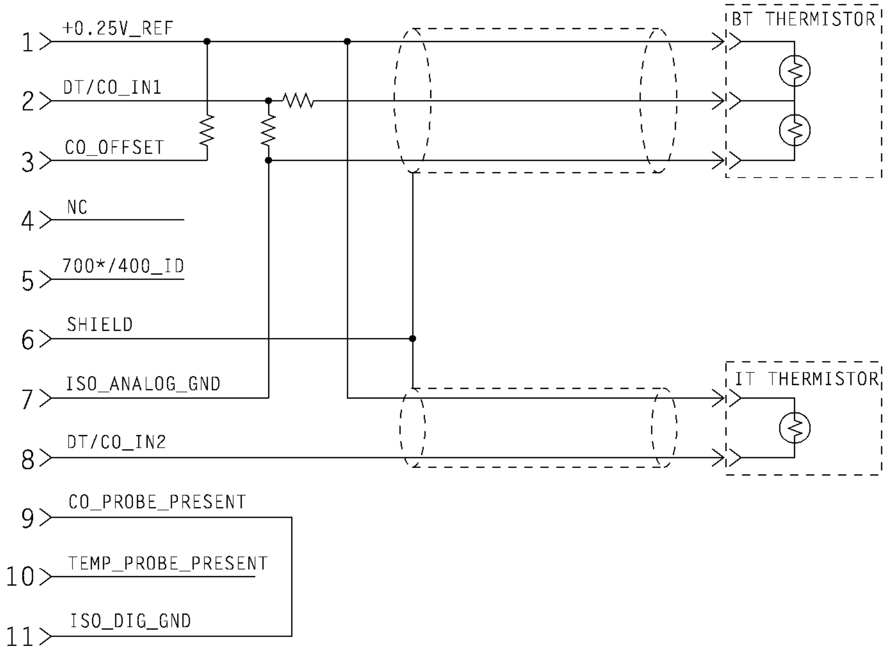
Table 6-9. CO Front Connector

Pin	Name	Type	
1	0.25VD REF	A stable +0.25-volt reference output for the thermistors	 **Front View of Brown-Colored TEMP/CO Connector**
2	DT/CO IN1	Channel 1 input	
3	CO_OFFSET	Catheter offset reference voltage	
4	NC		
5	700*/400ID	The TEMP cable connects this input to ISO_DIG_GND when YSI series 700 thermistors are used, and leaves it floating when YSI series 400 thermistors are used	
6	SHIELD	Cable shields are connected here	
7	ISO_ANALOG_GND	Isolated analog ground reference	
8	DT/CO IN2	Channel 2 input	
9	CO_PROBE_PRESENT	CO cables connect this input to ISO_DIG_GND to show that they are connected.	
10	TEMP_PROBE_PRESENT	TEMP cables connect this input to ISO_DIG_GND to show that they are connected.	
11	ISO_DIG_GND	Isolated digital ground	

The schematic diagram of the typical TEMP cable/thermistor schematic diagram is presented below.


1
+0.25V_REF
2
DT/CO_IN1
3
CO_OFFSET
4
NC
5
700*/400_ID
6
SHIELD
7
ISO_ANALOG_GND
8
DT/CO_IN2
9
CO_PROBE_PRESENT
10
TEMP_PROBE_PRESENT
11
ISO_DIG_GND
400
700
T1 THERMISTOR
T2 THERMISTOR

The schematic diagram of the typical CO cable/thermistor schematic diagram schematic diagram is presented below.


1
+0.25V_REF
2
DT/CO_IN1
3
CO_OFFSET
4
NC
5
700*/400_ID
6
SHIELD
7
ISO_ANALOG_GND
8
DT/CO_IN2
9
CO_PROBE_PRESENT
10
TEMP_PROBE_PRESENT
11
ISO_DIG_GND
BT THERMISTOR
IT THERMISTOR

7

TRAM 100A MODULE
PN 408000

Assembly Configurations 7-2

Exploded View PN 408000C 7-3

Schematic Diagram PN 408000C 7-5

Parts List PN 408000C 7-7

Revisions Assemblies 7-9

General

Circuit Boards

Details about the circuit boards contained in the Tram 100A are discussed in later chapters arranged by part number.

Table 7-1. Circuit Board Overview

Module Type	Upper Level	Leadwire Configuration	DAS Module	Acquisition Processor PCB	Module Processor PCB
Tram 100A	40800-0XX	5-Leadwire	408134-001	800330-005	800210-005

Tram 100A Configurations

Marquette manufactures 16 different configurations of this assembly at the time of this writing. The configurations differ in the power frequency, number of ECG leadwires, the type of labelling, and the units of measure used. The table below lists the available configurations.

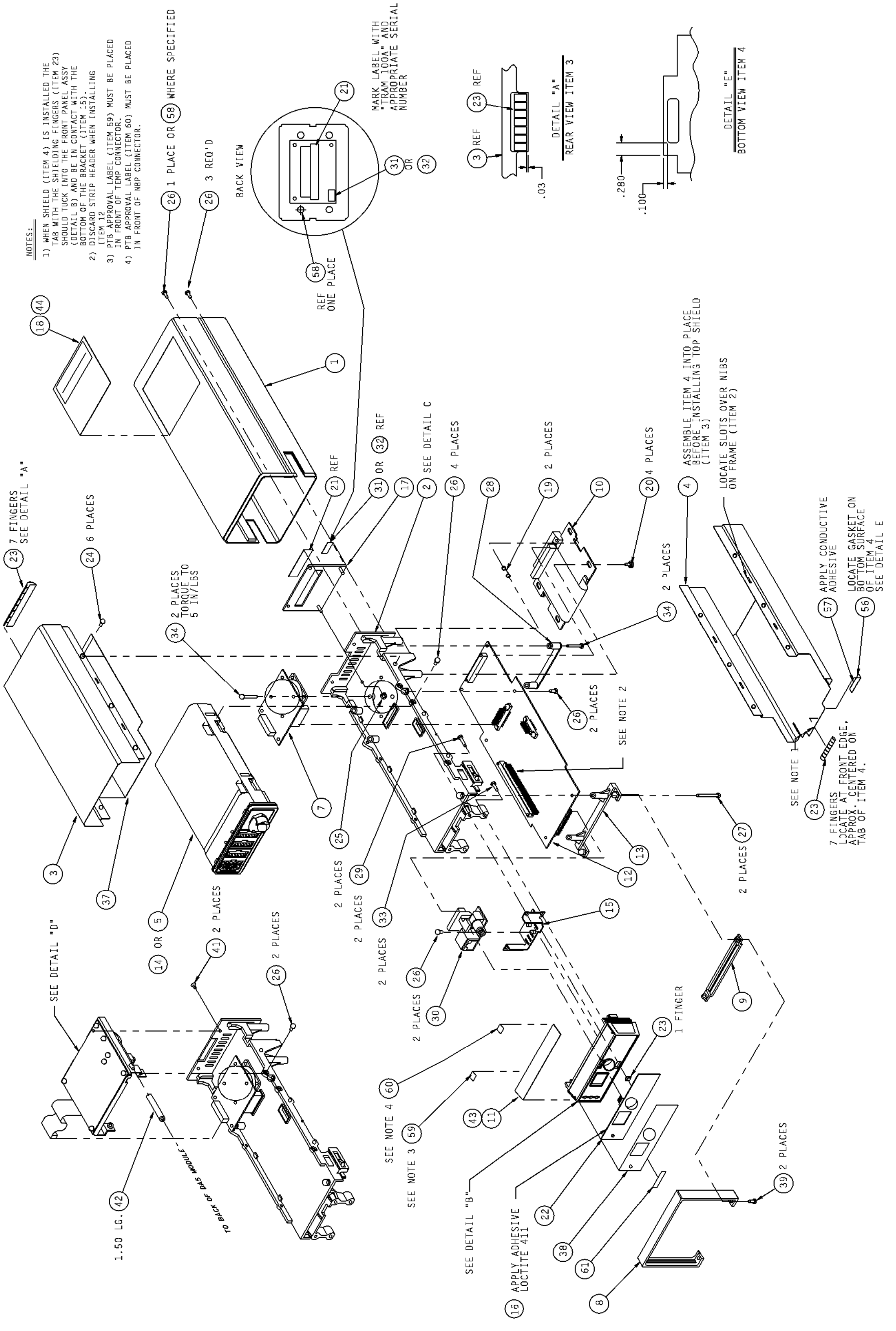
Table 7-2. Configurations

Part Number	Revision	Power *f* (Hz)	ECG Leadwires	Labels	Units of Measure
408000-001	B	60	5	English	English
408000-002	A	50	5	English	English
408000-003	B	60	5	English	English
408000-004	A	50	5	English	English
408000-005	A	60	5	English	SI
408000-006	A	50	5	English	SI
408000-007	A	60	5	English	SI
408000-008	A	50	5	English	SI
408000-011	A	60	5	Icon	English
408000-012	A	50	5	Icon	English
408000-013	A	60	5	Icon	English
408000-014	A	50	5	Icon	English
408000-015	A	60	5	Icon	SI
408000-016	B	50	5	Icon	SI
408000-017	A	60	5	Icon	SI
408000-018	B	50	5	Icon	SI

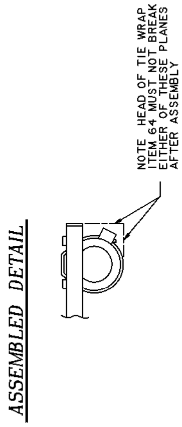
Part number 408000A without a dashed suffix (ie, pn 408000A, as opposed to pn 408000-001A or pn 408000-002A) refers to all of the assemblies listed in the table above. Unless otherwise noted, all assemblies are the same.

Exploded View PN 408000C

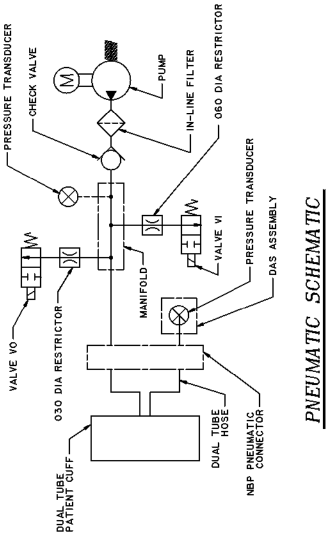
1 of 2


NOTES:
1) WHEN SHIELD (ITEM 4) IS INSTALLED THE TAB WITH THE SHIELDING FINGERS (ITEM 23) SHOULD TUCK INTO THE FRONT PANEL ASSY (DETAIL B) AND BE IN CONTACT WITH THE BOTTOM OF THE BRACKET (ITEM 5).
2) DISCARD STRIP HEADER WHEN INSTALLING ITEM 12
3) PTB APPROVAL LABEL (ITEM 59) MUST BE PLACED IN FRONT OF TEMP CONNECTOR.
4) PTB APPROVAL LABEL (ITEM 60) MUST BE PLACED IN FRONT OF NBP CONNECTOR.
26 1 PLACE OR 58 WHERE SPECIFIED
26 3 REQ'D
BACK VIEW
21
31 OR 32
58 REF ONE PLACE
MARK LABEL WITH "TRAM 100A" AND APPROPRIATE SERIAL NUMBER
3 REF
23 REF
.03
DETAIL "A" REAR VIEW ITEM 3
.280
.100
DETAIL "E" BOTTOM VIEW ITEM 4
18 44
1
23 7 FINGERS SEE DETAIL "A"
24 6 PLACES
21 REF
31 OR 32 REF
17
2 SEE DETAIL C
26 4 PLACES
28
19 2 PLACES
10
20 4 PLACES
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
34 2 PLACES TORQUE TO 5 IN/LBS
34 2 PLACES
57 APPLY CONDUCTIVE ADHESIVE
56 LOCATE GASKET ON BOTTOM SURFACE OF ITEM 4 SEE DETAIL E
26 2 PLACES
SEE NOTE 2
SEE NOTE 1
23 7 FINGERS LOCATE AT FRONT EDGE, APPROX. CENTERED ON TAB OF ITEM 4.
3
37
7
25
14 OR 5
29 2 PLACES
33 2 PLACES
13
12
27 2 PLACES
SEE DETAIL "D"
41 2 PLACES
26 2 PLACES
26 2 PLACES
30 2 PLACES
15
9
23 1 FINGER
60 SEE NOTE 4
59 SEE NOTE 3
43 11
42 1.50 LG.
TO BACK OF DAS MODULE
SEE DETAIL "B"
16 APPLY ADHESIVE LOCTITE 411
22
38
61
8
39 2 PLACES

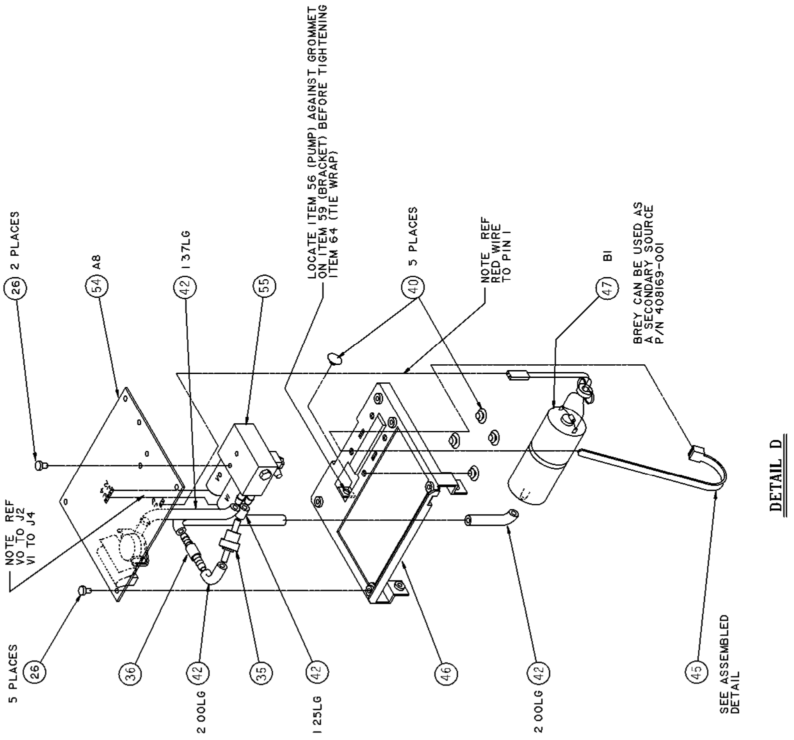
2 of 2


NOTE HEAD OF TIE WRAP
ITEM 64 MUST NOT BREAK
EITHER OF THESE PLANES
AFTER ASSEMBLY

ASSEMBLED DETAIL

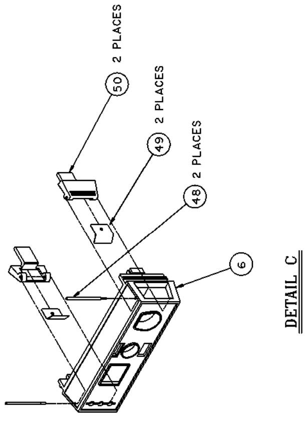

PRESSURE TRANSDUCER
CHECK VALVE
PUMP
M
IN-LINE FILTER
060 DIA RESTRICTOR
VALVE VO
030 DIA RESTRICTOR
MANIFOLD
VALVE VI
PRESSURE TRANSDUCER
DAS ASSEMBLY
DUAL TUBE PATIENT CUFF
DUAL TUBE HOSE
NBP PNEUMATIC CONNECTOR

PNEUMATIC SCHEMATIC

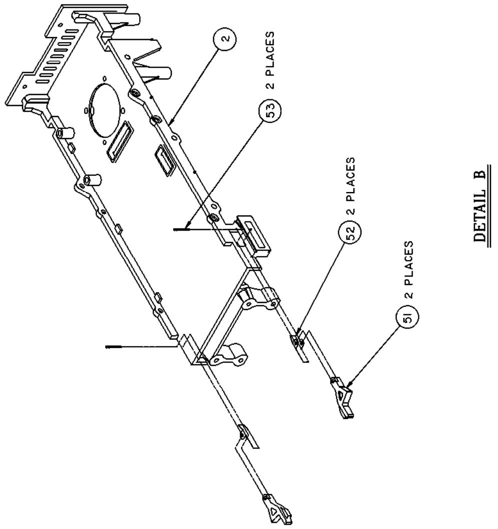

26 2 PLACES
54 A8
42 1 37LG
55
LOCATE ITEM 56 (PUMP) AGAINST GROMMET
ON ITEM 59 (BRACKET) BEFORE TIGHTENING
ITEM 64 (TIE WRAP)
40 5 PLACES
NOTE REF
RED WIRE
TO PIN 1
47 B1
BREY CAN BE USED AS
A SECONDARY SOURCE
P/N 408169-001
NOTE REF
VO TO J2
VI TO J4
5 PLACES 26
36
2 00LG 42
35
1 25LG 42
46
2 00LG 42
45 SEE ASSEMBLED DETAIL

DETAIL D

LEAD IDENT	ITEM NO	FROM	TO
W6	56	B1P3	A8J3
W4	57	W5P1	A8J2
W5	57	W4P1	A8J4


50 2 PLACES
49 2 PLACES
48 2 PLACES
6

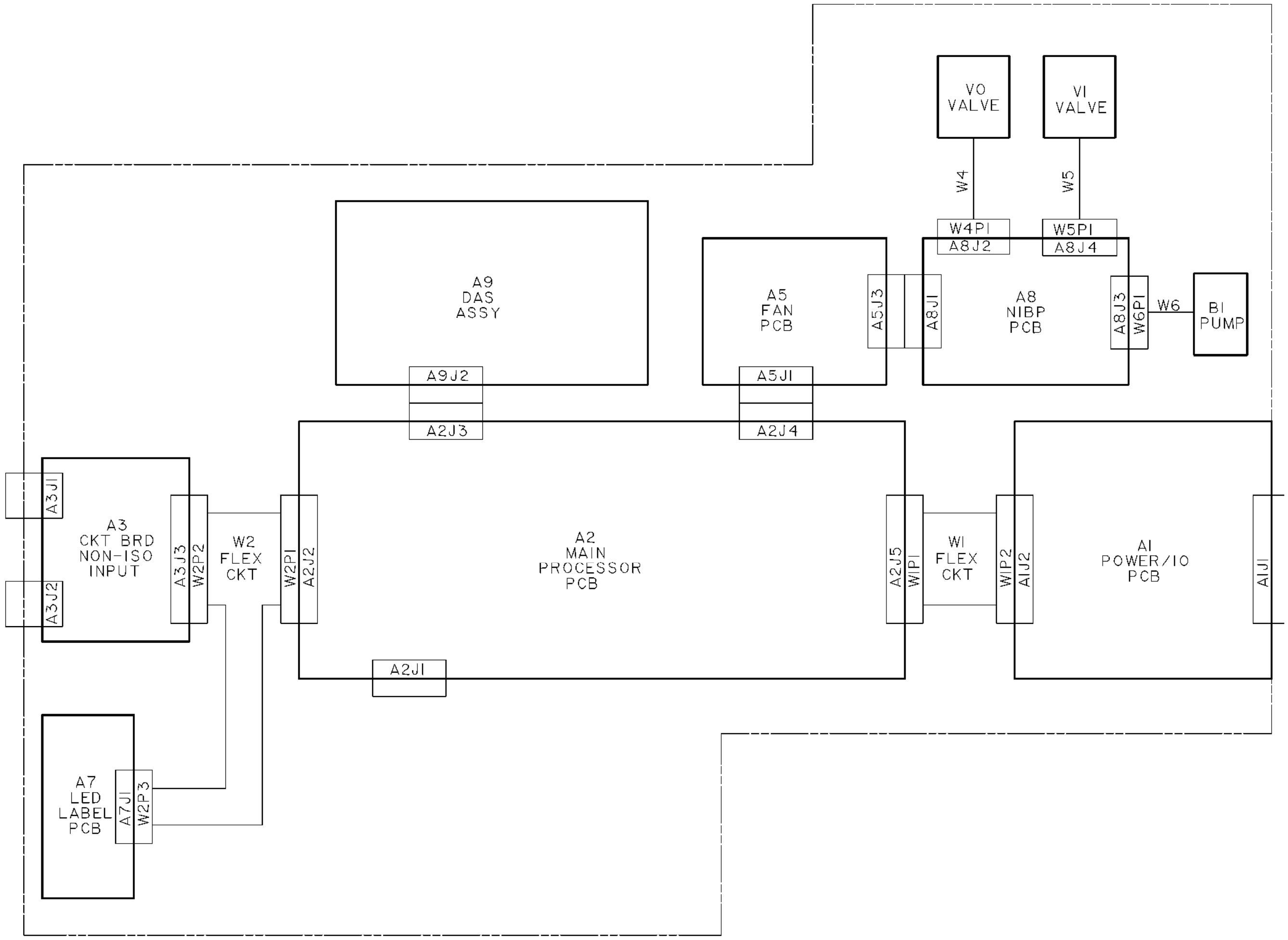
DETAIL C

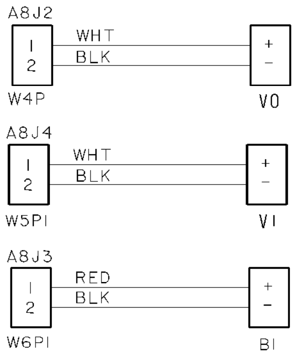

2
53 2 PLACES
52 2 PLACES
51 2 PLACES

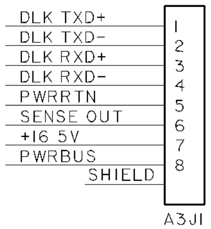
DETAIL B

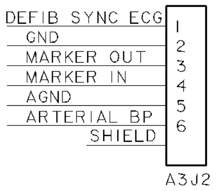
Schematic Diagram PN 408000C

1 of 2

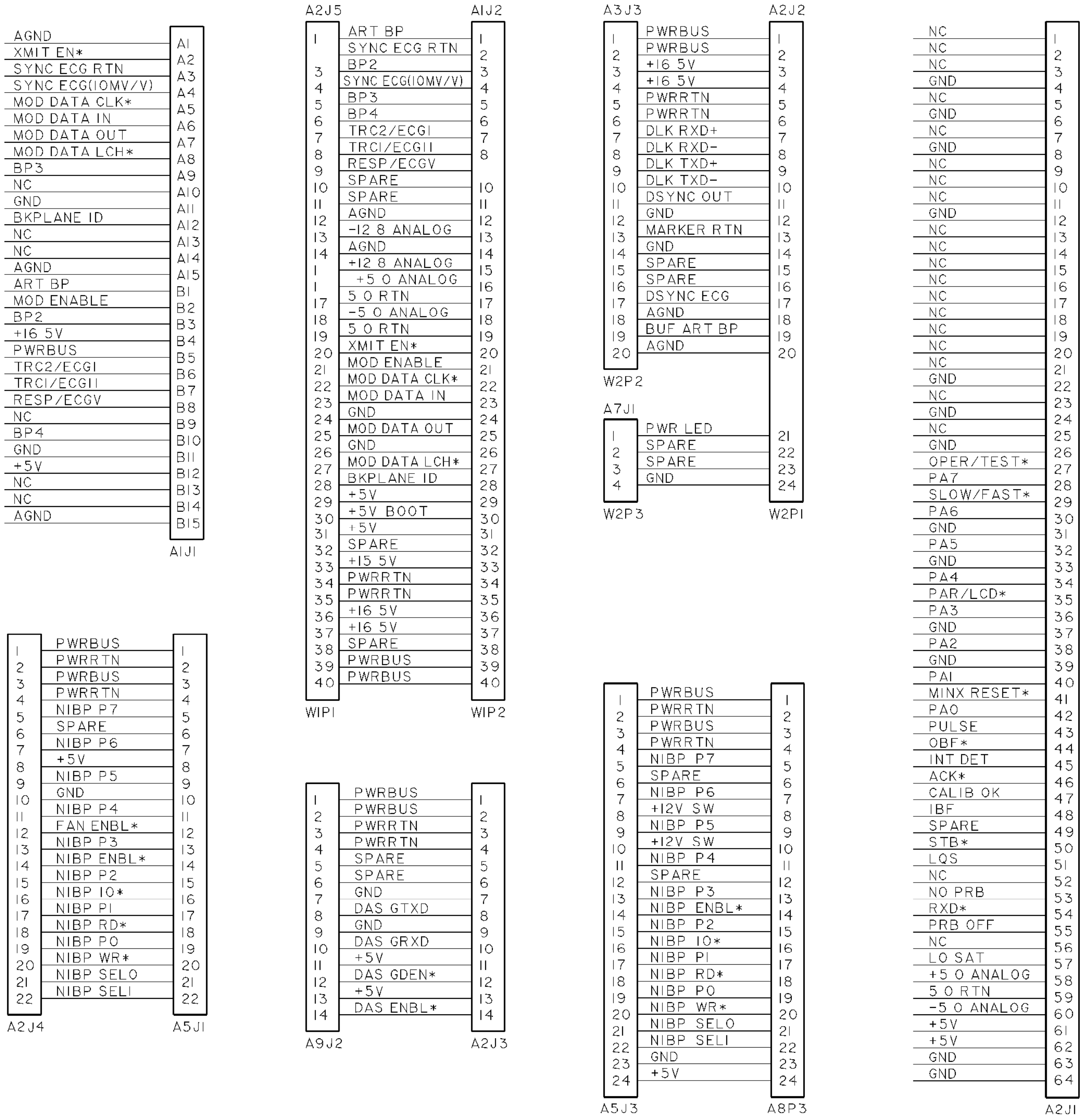

V0
VALVE
V1
VALVE
W4
W5
W4P1
A8J2
W5P1
A8J4
A9
DAS
ASSY
A5
FAN
PCB
A5J3
A8J1
A8
NIBP
PCB
A8J3
W6P1
W6
B1
PUMP
A9J2
A5J1
A2J3
A2J4
A3J1
A3
CKT BRD
NON-ISO
INPUT
A3J3
W2P2
W2
FLEX
CKT
W2P1
A2J2
A2
MAIN
PROCESSOR
PCB
A2J5
W1P1
W1
FLEX
CKT
W1P2
A1J2
A1
POWER/IO
PCB
A1J1
A3J2
A2J1
A7
LED
LABEL
PCB
A7J1
W2P3


A8J2
1
2
WHT
BLK
+
−
W4P
V0
A8J4
1
2
WHT
BLK
+
−
W5P1
V1
A8J3
1
2
RED
BLK
+
−
W6P1
B1


DLK TXD+
DLK TXD−
DLK RXD+
DLK RXD−
PWRRTN
SENSE OUT
+16.5V
PWRBUS
SHIELD
1
2
3
4
5
6
7
8
A3J1


DEFIB SYNC ECG
GND
MARKER OUT
MARKER IN
AGND
ARTERIAL BP
SHIELD
1
2
3
4
5
6
A3J2

2 of 2


A1J1
A1 AGND
A2 XMIT EN*
A3 SYNC ECG RTN
A4 SYNC ECG(10MV/V)
A5 MOD DATA CLK*
A6 MOD DATA IN
A7 MOD DATA OUT
A8 MOD DATA LCH*
A9 BP3
A10 NC
A11 GND
A12 BKPLANE ID
A13 NC
A14 NC
A15 AGND
B1 ART BP
B2 MOD ENABLE
B3 BP2
B4 +16 5V
B5 PWRBUS
B6 TRC2/ECGI
B7 TRC1/ECGII
B8 RESP/ECGV
B9 NC
B10 BP4
B11 GND
B12 +5V
B13 NC
B14 NC
B15 AGND
A2J5
A1J2
1 ART BP 1
SYNC ECG RTN 2
3 BP2 3
4 SYNC ECG(10MV/V) 4
5 BP3 5
6 BP4 6
7 TRC2/ECGI 7
8 TRC1/ECGII 8
9 RESP/ECGV
10 SPARE 10
11 SPARE 11
12 AGND 12
13 -12 8 ANALOG 13
14 AGND 14
1 +12 8 ANALOG 15
1 +5 0 ANALOG 16
17 5 0 RTN 17
18 -5 0 ANALOG 18
19 5 0 RTN 19
20 XMIT EN* 20
21 MOD ENABLE 21
22 MOD DATA CLK* 22
23 MOD DATA IN 23
24 GND 24
25 MOD DATA OUT 25
26 GND 26
27 MOD DATA LCH* 27
28 BKPLANE ID 28
29 +5V 29
30 +5V BOOT 30
31 +5V 31
32 SPARE 32
33 +15 5V 33
34 PWRRTN 34
35 PWRRTN 35
36 +16 5V 36
37 +16 5V 37
38 SPARE 38
39 PWRBUS 39
40 PWRBUS 40
W1P1
W1P2
A3J3
A2J2
1 PWRBUS 1
2 PWRBUS 2
3 +16 5V 3
4 +16 5V 4
5 PWRRTN 5
6 PWRRTN 6
7 DLK RXD+ 7
8 DLK RXD- 8
9 DLK TXD+ 9
10 DLK TXD- 10
11 DSYNC OUT 11
12 GND 12
13 MARKER RTN 13
14 GND 14
15 SPARE 15
16 SPARE 16
17 DSYNC ECG 17
18 AGND 18
19 BUF ART BP 19
20 AGND 20
W2P2
A7J1
1 PWR LED 21
2 SPARE 22
3 SPARE 23
4 GND 24
W2P3
W2P1
NC 1
NC 2
NC 3
GND 4
NC 5
GND 6
NC 7
GND 8
NC 9
NC 10
NC 11
GND 12
NC 13
NC 14
NC 15
NC 16
NC 17
NC 18
NC 19
NC 20
NC 21
GND 22
NC 23
GND 24
NC 25
GND 26
OPER/TEST* 27
PA7 28
SLOW/FAST* 29
PA6 30
GND 31
PA5 32
GND 33
PA4 34
PAR/LCD* 35
PA3 36
GND 37
PA2 38
GND 39
PA1 40
MINX RESET* 41
PA0 42
PULSE 43
OBF* 44
INT DET 45
ACK* 46
CALIB OK 47
IBF 48
SPARE 49
STB* 50
LQS 51
NC 52
NO PRB 53
RXD* 54
PRB OFF 55
NC 56
LO SAT 57
+5 0 ANALOG 58
5 0 RTN 59
-5 0 ANALOG 60
+5V 61
+5V 62
GND 63
GND 64
A2J1
1 PWRBUS 1
2 PWRRTN 2
3 PWRBUS 3
4 PWRRTN 4
5 NIBP P7 5
6 SPARE 6
7 NIBP P6 7
8 +5V 8
9 NIBP P5 9
10 GND 10
11 NIBP P4 11
12 FAN ENBL* 12
13 NIBP P3 13
14 NIBP ENBL* 14
15 NIBP P2 15
16 NIBP IO* 16
17 NIBP P1 17
18 NIBP RD* 18
19 NIBP P0 19
20 NIBP WR* 20
21 NIBP SEL0 21
22 NIBP SEL1 22
A2J4
A5J1
1 PWRBUS 1
2 PWRBUS 2
3 PWRRTN 3
4 PWRRTN 4
5 SPARE 5
6 SPARE 6
7 GND 7
8 DAS GTXD 8
9 GND 9
10 DAS GRXD 10
11 +5V 11
12 DAS GDEN* 12
13 +5V 13
14 DAS ENBL* 14
A9J2
A2J3
1 PWRBUS 1
2 PWRRTN 2
3 PWRBUS 3
4 PWRRTN 4
5 NIBP P7 5
6 SPARE 6
7 NIBP P6 7
8 +12V SW 8
9 NIBP P5 9
10 +12V SW 10
11 NIBP P4 11
12 SPARE 12
13 NIBP P3 13
14 NIBP ENBL* 14
15 NIBP P2 15
16 NIBP IO* 16
17 NIBP P1 17
18 NIBP RD* 18
19 NIBP P0 19
20 NIBP WR* 20
21 NIBP SEL0 21
22 NIBP SEL1 22
23 GND 23
24 +5V 24
A5J3
A8P3

Parts List PN 408000C

Item	Reference Designation	Parts List	Part Number	Qty
		Cover, Module	400895-001	1
2		Frame	400982-001	1
3		Shield, Top	401679-001	1
4		Shield, Bottom	401679-002	1
5	A9	100/200 Acquisition Module, 5-Lead	408134-001	*
6		Front Bezel, Lower	401105-005	1
7	A5	Fan PCB Assembly	403549-002	1
8		Trim, Rubber, Front Bezel	404620-001	1
9		Mounting Strap, Trim	404621-001	1
10	A1, W1	Power Supply PCB Assembly	401309-002	1
11		Label, Isolated Connector Function, Tram100A/200A, English	402313-001	*
12	A2	Module Processor PCB Assembly	800210-001	1
13		Circuit Board/Bezel Mount	404762-001	1
14	A9	Tram 100/200 Data Acquisition Module, 10-Lead	408134-002	*
15		Plate, Chassis Ground, Bottom/Front	402317-001	1
16		Adhesive, Loctite Prism 411	4851-082	AR
17		Plate, Chassis Ground, Rear	404680-002	1
18		Label, Cover, English	403439-001	*
19		Spring, Compression	402315-001	2
20		Screw, Power Supply PCB Mounting, SST, 4-40	402214-001	4
21		Label, Model/Serial Number	404525-006	1
22	A7	Power Indicator PCB Assembly	403170-009	1
23		Spring, Chassis Ground, Rear	403741-001	AR
24		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
25		Nut, Hex, 4-40	4521-304	2
26		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	21
27		Screw, BDGH, Phillips, 4-40 x 1-1/8	45074-436	2
28		Bracket, Power Supply PCB	406254-001	1
29		Screw, 4-40 x 7/8	404069-001	2
30	A3, W2	Non-Isolated Input PCB Assembly	401315-002	1
31		Label, 60-Hz	70386-001	*
32		Label, 50-Hz	70386-002	*
33		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
34		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
35		Check Valve, 0.125 ID	404675-001	1
36		Filter, 43 Micron	404679-001	1
37		Insulator, Bottom Shield	404188-001	1
38		Label, Lower Bezel	408162-001	1
39		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
40		Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness	404749-001	5

Item	Reference Designation	Parts List	Part Number	Qty
41		Screw, FLH, Phillips, SST, 4-40 x 3/8	4505-412	2
42		Tubing, Silastic	401582-001	AR
43		Label, Isolated Connector Function, Tram 100A/ 200A, Icon	402313-002	*
44		Label, Cover, Icon	403439-002	*
45		Tie Wrap	4535-002	1
46		Bracket, NBP Mounting	404296-001	1
47	B1, W6	Pump Assembly, NBP, w/Harness	408169-002	1
48		Pin, Latch	402806-001	2
49		Spring, Flat, SST	405041-001	2
50		Button, Latch	402106-001	2
51		Latch	401682-001	2
52		Spring, Latch	406019-001	2
53		Pin, Latch	406037-001	2
54	A8	NBP PCB Assembly	800316-001	1
55	V0, V1, W4, W5	NBP Valve Assembly	404459-001	1
56		Gasket, Silver-Nickel	407894-001	1
57		Adhesive, Conductive	4851-088	AR
58		Screw, PNHD, 4-40 x 0.188	409009-001	*
59		Label, PTB Approval	409047-002	*
60		Label, PTB Approval	409047-001	*
61		Label, Leadwire Warning	414097-001	*

*See the following chart:

	Assembly Configuration															
Item	-001	-002	-003	-004	-005	-006	-007	-008	-011	-012	-013	-014	-015	-016	-017	-018
5	1	1	–	–	1	1	–	–	1	1	–	–	1	1	–	–
11	1	1	1	1	1	1	1	1	–	–	–	–	–	–	–	–
14	–	–	1	1	–	–	1	1	–	–	1	1	–	–	1	1
18	1	1	1	1	1	1	1	1	–	–	–	–	–	–	–	–
31	1	–	1	–	1	–	1	–	1	–	1	–	1	–	1	–
32	–	1	–	1	–	1	–	1	–	1	–	1	–	1	–	1
43	–	–	–	1	–	–	–	–	1	1	1	1	1	1	1	1
44	–	–	–	–	–	–	–	–	1	1	1	1	1	1	1	1
58	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
59	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
60	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
61	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–

Assembly Revisions PN 408000

The baseline revision for this assembly is pn 408000C. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 408000A

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
58		Screw, BDGH, 4-40 x 0.188	45074-406	40900-001	*
59		Label, German PTB	Not Used	409047-002	1
60		Label, German PTB	Not Used	409047-001	1
61		Label, Leadwires Warning	Not Used	414097-001	1

PN 408000B

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
61		Label, Leadwires Warning	Not Used	414097-001	1

For your notes

8

TRAM 200A/SL MODULE PN 408001/411160

General **8-2**
Circuit Boards 8-2
Tram 200A Configurations 8-2

Exploded View PN 408001C **8-3**

Schematic Diagram PN 408001C **8-5**

Parts List PN 408001C **8-8**

Assembly Revisions PN 408001 .... **8-11**

Exploded View PN 411160-001H **8-12**

Schematic Diagram PN 411160-001H **8-14**

Parts List PN 411160-001H **8-17**

Assembly Revisions PN 411160 .... **8-20**

General

Circuit Boards

Details about the circuit boards contained in the Tram 200A/SL are discussed in later chapters arranged by part number.

Table 8-1. Circuit Board Overview

Module Type	Upper Level	Leadwire Configuration	DAS Module	Acquisition Processor PCB	Module Processor PCB
Tram 200A	408001-0XXA–C	5-Leadwire	408134-002	800330-006	800210-005
Tram 200SL	411160-001A–G	10-Leadwire	411166-001	800330-006	800210-005
Tram 200SL	411160-001H	10-Leadwire	417120-001 (Replaced 411166-001)	801040-001	800210-005

Tram 200A Configurations

At the time of this writing, 16 configurations of the Tram 200A module are available. The differences between configurations are in the power frequency, the type of labelling, and the units of measure used. The table below lists the available configurations.

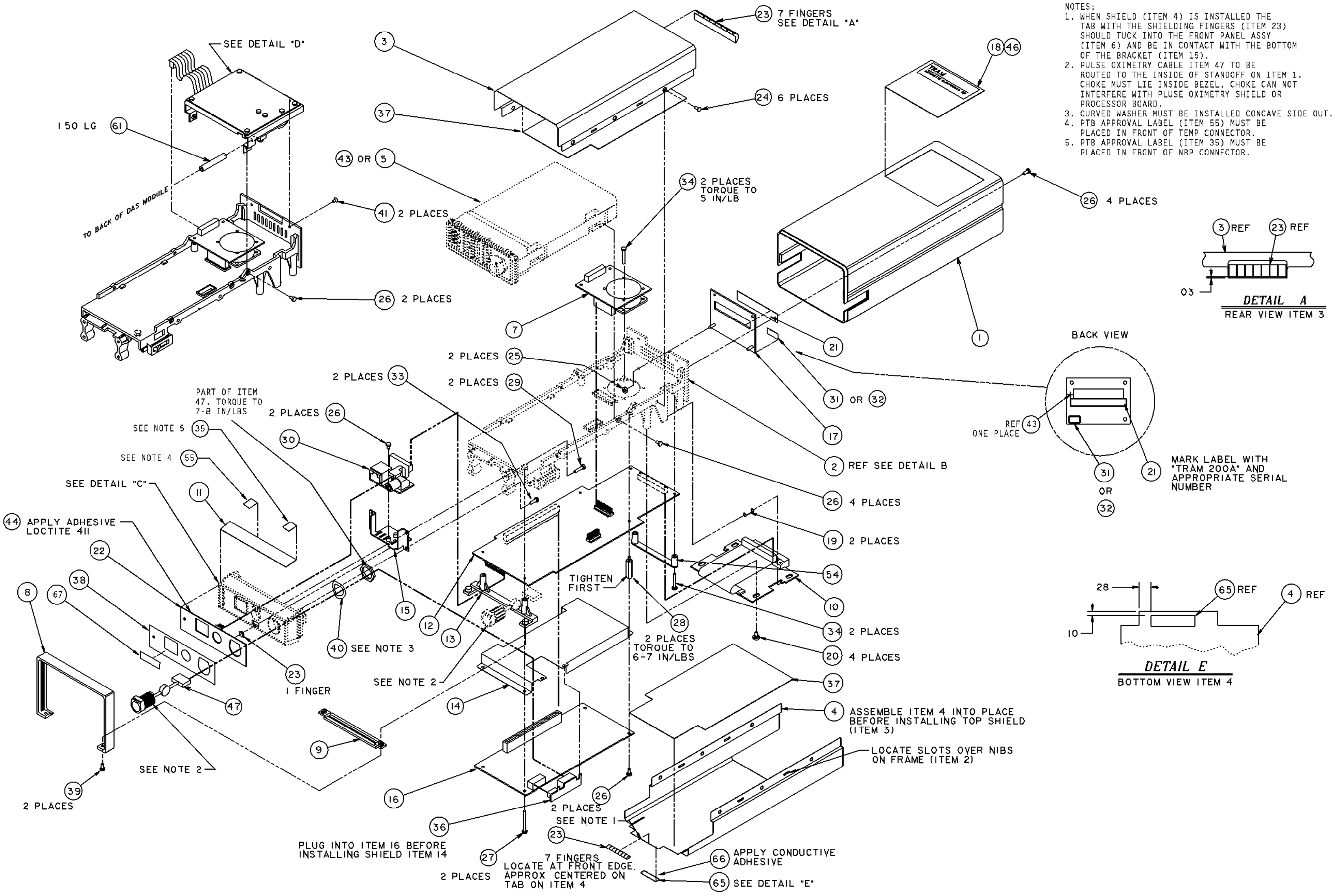
Table 8-2. Configurations

Part Number	Rev	Power *f* (Hz)	Labels	Units of Measure
408001-001	B	60	English	English
408001-002	A	50	English	English
408001-003	B	60	English	English
408001-004	A	50	English	English
408001-005	A	60	English	SI
408001-006	A	50	English	SI
408001-007	A	60	English	SI
408001-008	A	50	English	SI
408001-011	A	60	Icon	English
408001-012	A	50	Icon	English
408001-013	A	60	Icon	English
408001-014	A	50	Icon	English
408001-015	A	60	Icon	SI
408001-016	B	50	Icon	SI
408001-017	A	60	Icon	SI
408001-018	B	50	Icon	SI

Part number 408001A without a dashed suffix (ie, pn 408001A, as opposed to pn 408001-001A or pn 408000-002A) refers to all of the assemblies listed in the table above. Unless otherwise noted, all assemblies are the same.

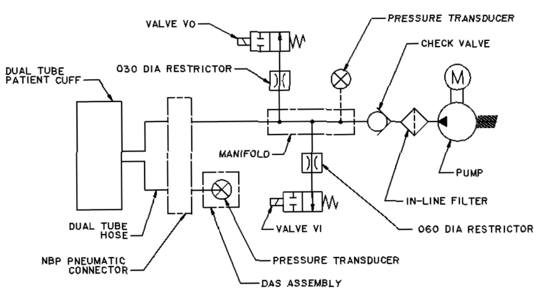
Exploded View PN 408001C

1 of 2


23 7 FINGERS SEE DETAIL "A"
18 46
3
37
24 6 PLACES
26 4 PLACES
SEE DETAIL "D"
150 LG 61
43 OR 5
34 2 PLACES TORQUE TO 5 IN/LB
TO BACK OF DAS MODULE
41 2 PLACES
26 2 PLACES
3 REF
23 REF
03
DETAIL A
REAR VIEW ITEM 3
1
BACK VIEW
REF 43 ONE PLACE
31 OR 32
21
MARK LABEL WITH "TRAM 200A" AND APPROPRIATE SERIAL NUMBER
7
2 PLACES 25
2 PLACES 29
2 PLACES 33
21
31 OR 32
17
2 REF SEE DETAIL B
PART OF ITEM 47. TORQUE TO 7-8 IN/LBS
2 PLACES 26
SEE NOTE 5 35
30
SEE NOTE 4 55
SEE DETAIL "C"
11
44 APPLY ADHESIVE LOCTITE 411
22
8
67
38
26 4 PLACES
19 2 PLACES
54
10
TIGHTEN FIRST
28 2 PLACES TORQUE TO 6-7 IN/LBS
34 2 PLACES
20 4 PLACES
37
15
12
13
40 SEE NOTE 3
23 1 FINGER
SEE NOTE 2
14
47
9
SEE NOTE 2
39 2 PLACES
16
36 PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
27 2 PLACES
26 2 PLACES
SEE NOTE 1
23 7 FINGERS LOCATE AT FRONT EDGE. APPROX CENTERED ON TAB ON ITEM 4
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
66 APPLY CONDUCTIVE ADHESIVE
65 SEE DETAIL "E"
28
10
65 REF
4 REF
DETAIL E
BOTTOM VIEW ITEM 4

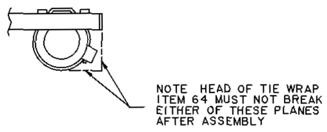
NOTES;
1. WHEN SHIELD (ITEM 4) IS INSTALLED THE TAB WITH THE SHIELDING FINGERS (ITEM 23) SHOULD TUCK INTO THE FRONT PANEL ASSY (ITEM 6) AND BE IN CONTACT WITH THE BOTTOM OF THE BRACKET (ITEM 15).
2. PULSE OXIMETRY CABLE ITEM 47 TO BE ROUTED TO THE INSIDE OF STANDOFF ON ITEM 1. CHOKE MUST LIE INSIDE BEZEL. CHOKE CAN NOT INTERFERE WITH PLUSE OXIMETRY SHIELD OR PROCESSOR BOARD.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. PTB APPROVAL LABEL (ITEM 55) MUST BE PLACED IN FRONT OF TEMP CONNECTOR.
5. PTB APPROVAL LABEL (ITEM 35) MUST BE PLACED IN FRONT OF NBP CONNECTOR.

2 of 2

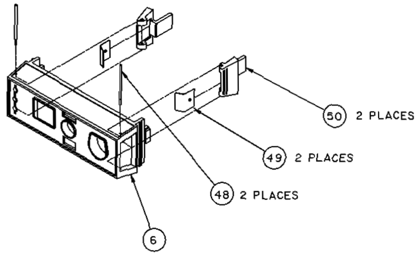

VALVE VO
PRESSURE TRANSDUCER
CHECK VALVE
DUAL TUBE PATIENT CUFF
030 DIA RESTRICTOR
M
MANIFOLD
PUMP
IN-LINE FILTER
VALVE VI
060 DIA RESTRICTOR
DUAL TUBE HOSE
NBP PNEUMATIC CONNECTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY

PNEUMATIC SCHEMATIC

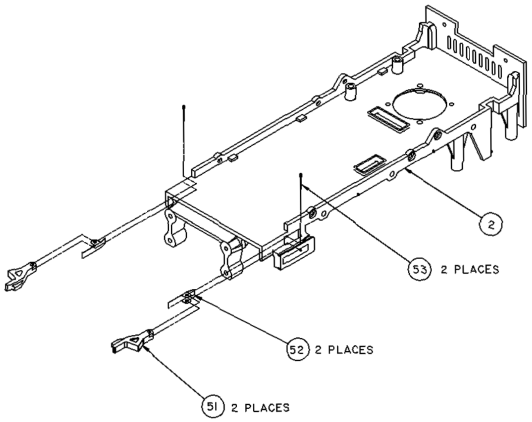
ASSEMBLED DETAIL


NOTE HEAD OF TIE WRAP ITEM 64 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY

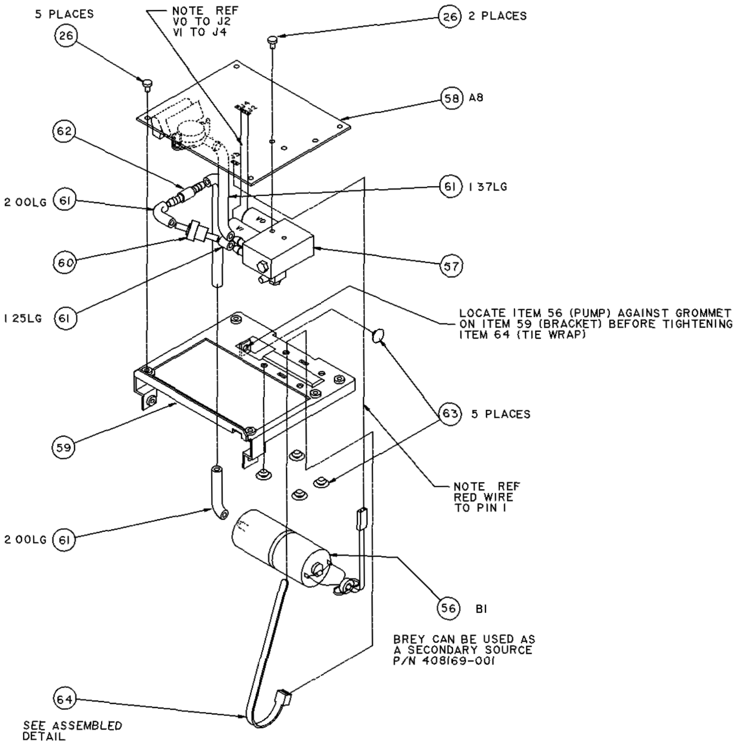
LEAD IDENT	ITEM NO	FROM	TO
W6	56	BIP3	A8J3
W4	57	W4P2	A8J2
W5	57	W5P4	A8J4


50 2 PLACES
49 2 PLACES
48 2 PLACES
6

DETAIL C


2
53 2 PLACES
52 2 PLACES
51 2 PLACES

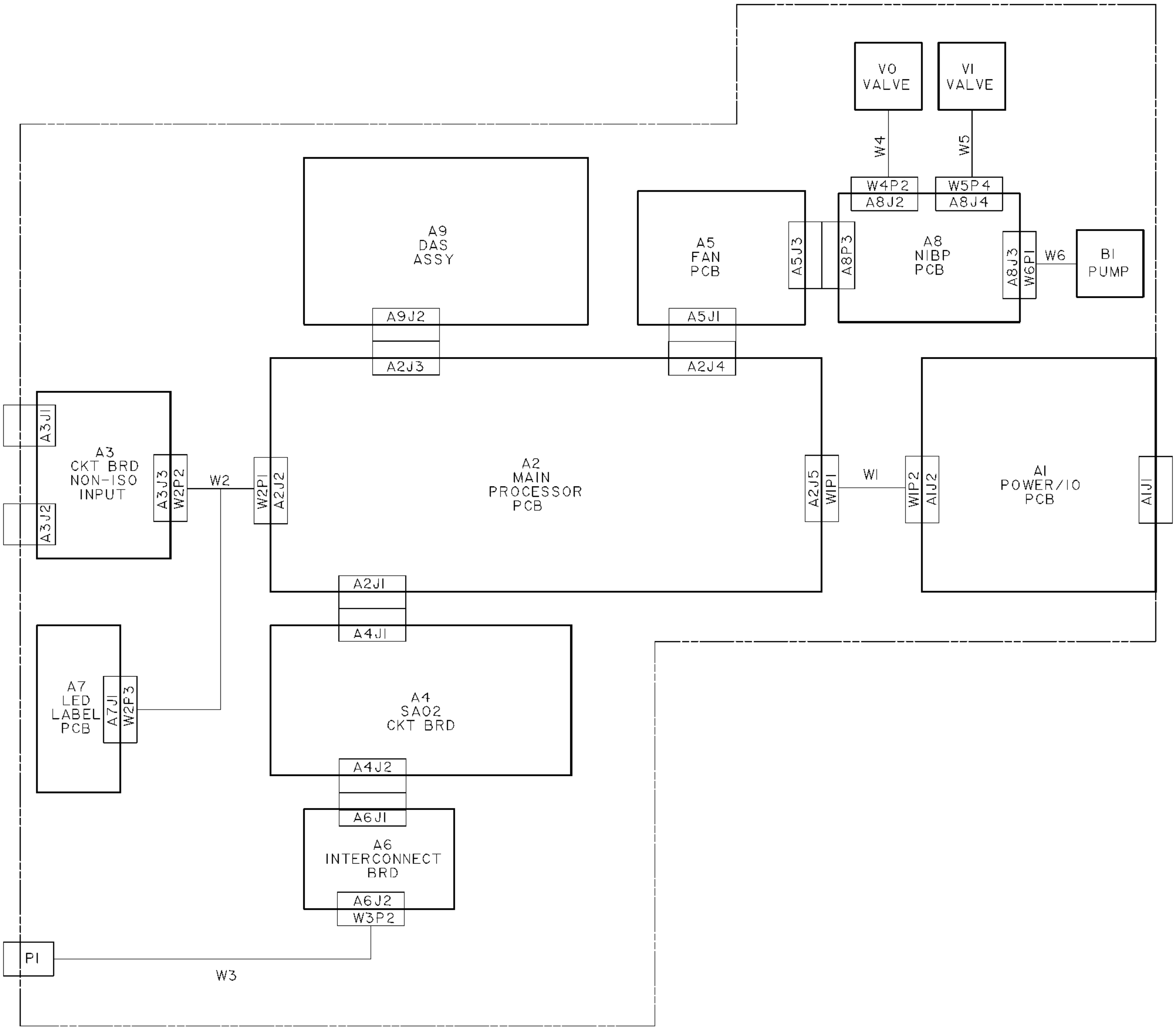
DETAIL B


5 PLACES 26
NOTE REF VO TO J2 VI TO J4
26 2 PLACES
58 A8
62
2 00LG 61
61 1 37LG
60
57
1 25LG 61
LOCATE ITEM 56 (PUMP) AGAINST GROMMET ON ITEM 59 (BRACKET) BEFORE TIGHTENING ITEM 64 (TIE WRAP)
59
63 5 PLACES
NOTE REF RED WIRE TO PIN 1
2 00LG 61
56 B1
BREY CAN BE USED AS A SECONDARY SOURCE P/N 408169-001
64
SEE ASSEMBLED DETAIL

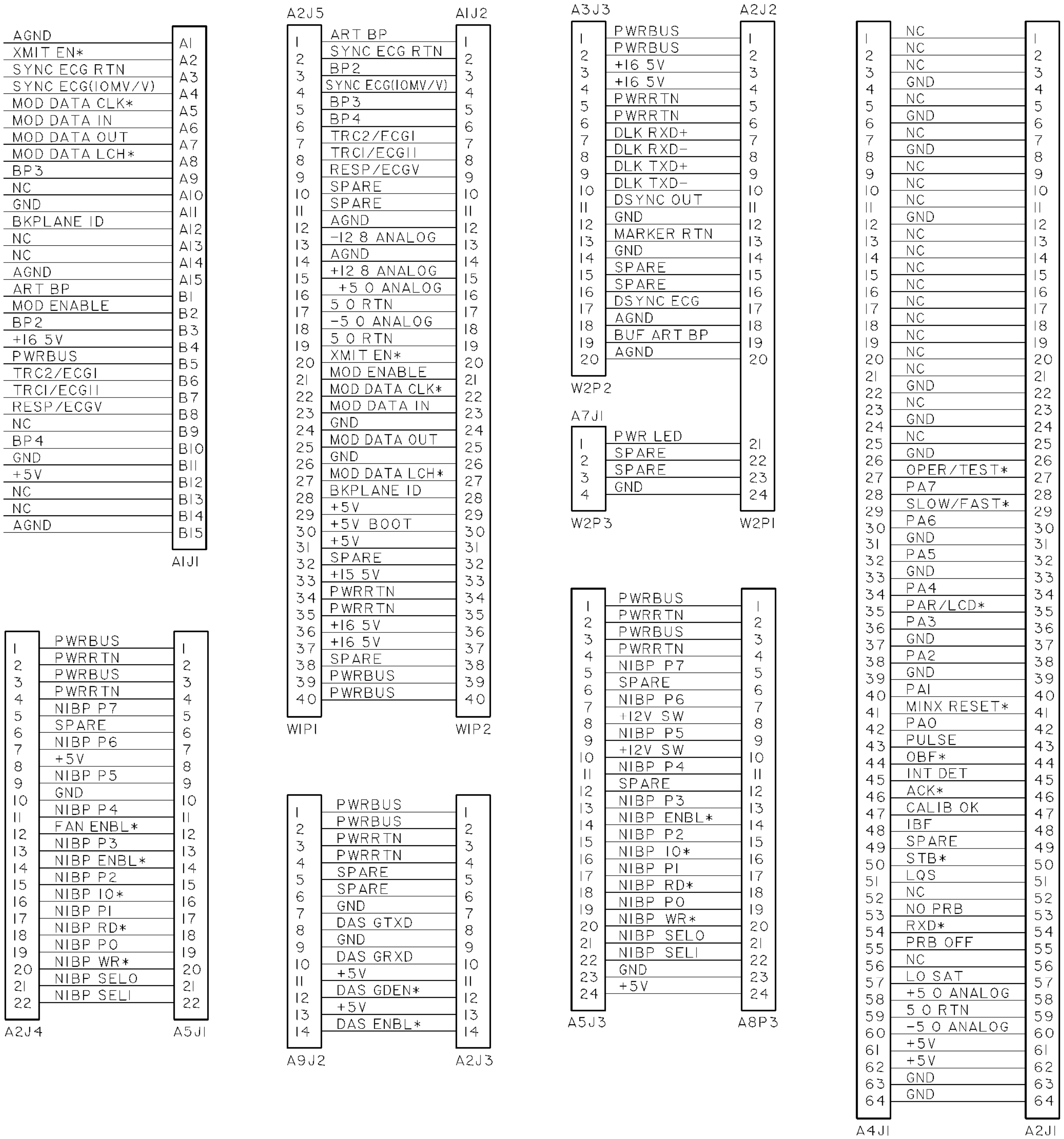
DETAIL D

Schematic Diagram PN 408001C

1 of 3


VO VALVE
VI VALVE
W4
W5
W4P2
W5P4
A8J2
A8J4
A9 DAS ASSY
A5 FAN PCB
A5J3
A8P3
A8 NIBP PCB
A8J3
W6PI
W6
BI PUMP
A9J2
A5JI
A2J3
A2J4
A3JI
A3 CKT BRD NON-ISO INPUT
A3J3
W2P2
W2
W2PI
A2J2
A2 MAIN PROCESSOR PCB
A2J5
WIPI
WI
WIP2
AIJ2
AI POWER/IO PCB
AIJI
A3J2
A2JI
A4JI
A7 LED LABEL PCB
A7JI
W2P3
A4 SA02 CKT BRD
A4J2
A6JI
A6 INTERCONNECT BRD
A6J2
W3P2
PI
W3

2 of 3



	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD DATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBUS	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J5		A1J2
1	ART BP	1
2	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	9
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
15	+12 8 ANALOG	15
16	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40
W1P1		W1P2

A3J3		A2J2
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20
W2P2		
A7J1		
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24
W2P3		W2P1

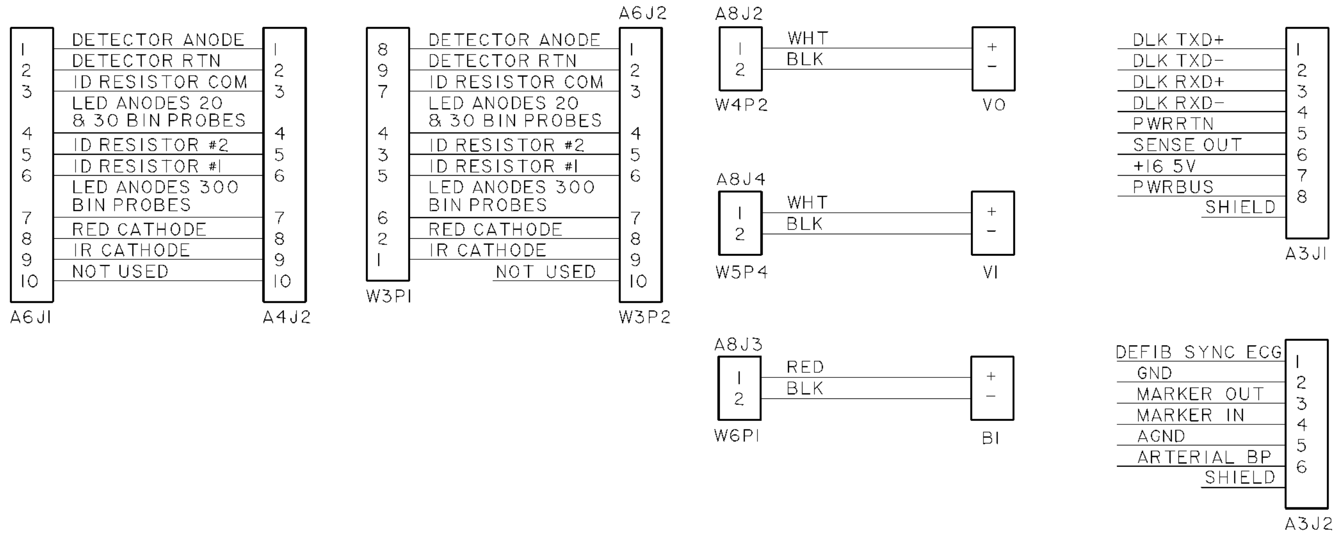
A4J1		A2J1
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64

A2J4		A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A9J2		A2J3
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A5J3		A8P3
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+12V SW	8
9	NIBP P5	9
10	+12V SW	10
11	NIBP P4	11
12	SPARE	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
23	GND	23
24	+5V	24

3 of 3


A6J1
A4J2
1 DETECTOR ANODE 1
2 DETECTOR RTN 2
3 ID RESISTOR COM 3
LED ANODES 20 & 30 BIN PROBES
4 ID RESISTOR #2 4
5 ID RESISTOR #1 5
6 LED ANODES 300 BIN PROBES 6
7 RED CATHODE 7
8 IR CATHODE 8
9 9
10 NOT USED 10
W3P1
A6J2
W3P2
8 DETECTOR ANODE 1
9 DETECTOR RTN 2
7 ID RESISTOR COM 3
LED ANODES 20 & 30 BIN PROBES
4 ID RESISTOR #2 4
3 ID RESISTOR #1 5
5 LED ANODES 300 BIN PROBES 6
6 RED CATHODE 7
2 IR CATHODE 8
1 9
NOT USED 10
A8J2
W4P2
1 WHT +
2 BLK −
VO
A8J4
W5P4
1 WHT +
2 BLK −
V1
A8J3
W6P1
1 RED +
2 BLK −
B1
DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16 5V 7
PWRBUS 8
SHIELD
A3J1
DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2

Parts List PN 408001C

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3		Shield, Top	401679-001	1
4		Shield, Bottom	401679-002	1
5	A9	100/200 Acquisition Module, 5-Lead	408134-001	*
6		Front Bezel, Lower	401105-004	1
7	A5	Fan PCB	403549-002	1
8		Trim, Rubber, Front Bezel	404620-001	1
9		Mounting Strap, Trim	404621-001	1
10	A1	Power Supply PCB	401309-002	1
11		Label, Isolated Connector Function, Tram 100A/ 200A, English	402313-001	*
12	A2	Module Processor PCB	800210-001	1
13		Circuit Board/Bezel Mount	404672-001	1
14		Shield, Pulse Oximetry PCB	401680-001	1
15		Plate, Chassis Ground, Bottom/Front	402317-001	1
16	A4	Pulse Oximetry PCB	401189-001	1
17		Plate, Chassis Ground, Rear	404680-002	1
18		Label, Cover, English	403439-001	*
19		Spring, Compression	402315-001	2
20		Screw, Power Supply PCB Mounting, SST, 4-40	402214-001	4
21		Label, Model/Serial Number	404525-006	1
22	A7	Power Indicator PCB	403170-008	1
23		Spring, Chassis Ground, Rear	403741-001	AR
24		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
25		Nut, Hex, 4-40	4521-304	2
26		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	19
27		Screw, BDGH, Phillips, 4-40 x 1-3/8	45074-438	2
28		Spacer, Male/Female, 4-40 x 0.875	4656-414	2
29		Screw, 4-40 x 7/8	404069-001	2
30	A3, W2	Non-Isolated Input PCB	401315-002	1
31		Label, 60-Hz	70386-001	*
32		Label, 50-Hz	70386-002	*
33		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
34		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
35		Label, PTB Approval	409047-001	*
36	A6	Interconnect PCB	800006-001	1
37		Insulator, Bottom Shield	404188-001	2
38		Label, Lower Bezel	408162-002	1
39		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
40		Washer, Pulse Oximetry Connector	4550-250	1

Item	Reference Designation	Parts List	Part Number	Qty
41		Screw, FLH, Phillips, SST, 4-40 x 3/8	4505-412	2
42		Screw, PNHD, 4-40 x 0.188	409009-001	*
43	A9	Tram 100/200 Data Acquisition Module, 10-Lead	408134-002	*
44		Adhesive, Loctite Prism 411	4851-082	AR
45		Label, Isolated Connector Function, Tram 100A/ 200A, English	402313-001	*
46		Label, Cover, Icon	403439-002	*
47	W3	Harness, Pulse Oximetry PCB-to-Connector	700091-001	1
48		Pin, Latch	402806-001	2
49		Spring, Flat, SST	405041-001	2
50		Button, Latch	402106-001	2
51		Latch	401682-001	2
52		Spring, Latch	406019-001	2
53		Pin, Latch	406037-001	2
54		Bracket, Power Supply PCB	406254-001	1
55		Label, PTB Approval	409047-002	*
56	B1, W6	Pump Assembly, NBP, w/Harness	408169-002	1
57	V0, V1, W4, W5	NBP Valve Assembly	404459-001	1
58	A8	NBP PCB	800316-001	1
59		Bracket, NBP Mounting	404296-001	1
60		Check Valve, 0.125 ID	404675-001	1
61		Tubing, Silastic	401582-001	AR
62		Filter, 43 Micron	404679-001	1
63		Grommet, 1/4 Dia, 1/8 High, 1/16 Panel		
		Thickness	404749-001	5
64		Tie Wrap	4535-002	1
65		Gasket, Silver-Nickel	407894-001	1
66		Adhesive, Conductive	4851-088	AR
67		Label, Leadwire Warning	414097-001	*

*See the following chart:

Item	Assembly Configuration															
	-001	-002	-003	-004	-005	-006	-007	-008	-011	-012	-013	-014	-015	-016	-017	-018
5	1	1	–	–	1	1	–	–	1	1	–	–	1	1	–	–
11	1	1	1	1	1	1	1	1	–	–	–	–	–	–	–	–
18	1	1	1	1	1	1	1	1	–	–	–	–	–	–	–	–
31	1	–	1	–	1	–	1	–	1	–	1	–	1	–	1	–
32	–	1	–	1	–	1	–	1	–	1	–	1	–	1	–	1
35	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
42	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
43	–	–	1	1	–	–	1	1	–	–	1	1	–	–	1	1
45	–	–	–	–	–	–	–	–	1	1	1	1	1	1	1	1
46	–	–	–	–	–	–	–	–	1	1	1	1	1	1	1	1
55	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
67	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–

Assembly Revisions PN 408001

The baseline revision for this assembly is pn 408001C. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 408001A

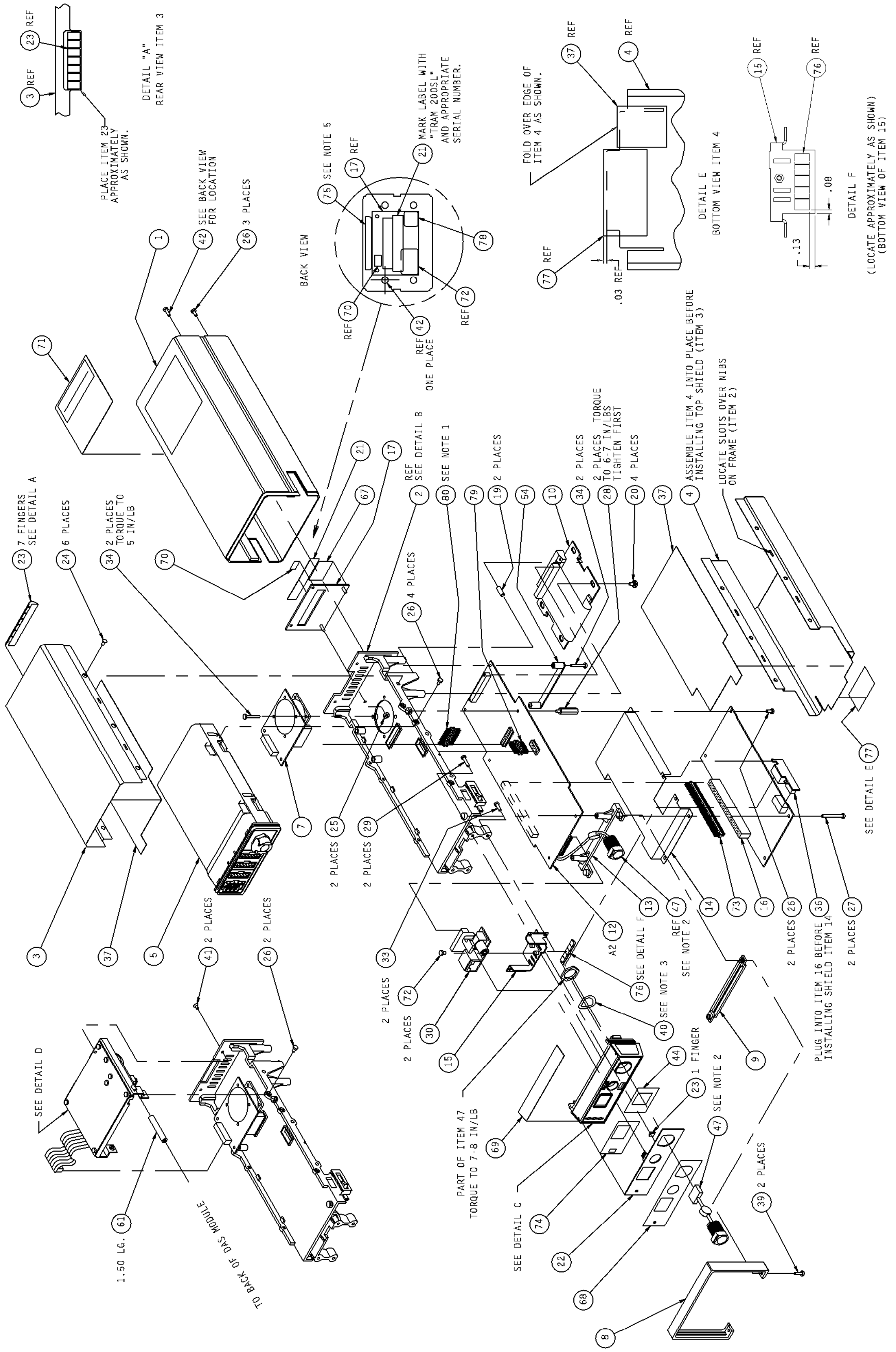
Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35		Label, German PTB	Not Used	409047-001	1
35		Screw, BDGH, 4-40 x 0.188	45074-406	409009-001	*
55		Label, German PTB	Not Used	409047-002	1
67		Label, Leadwires Warning	Not Used	414097-001	*

PN 408001B

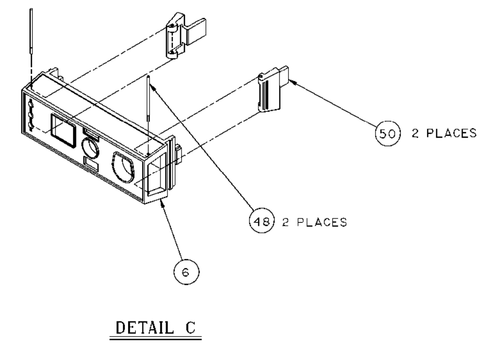
Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
67		Label, Leadwires Warning	Not Used	414097-001	*

Exploded View PN 411160-001H

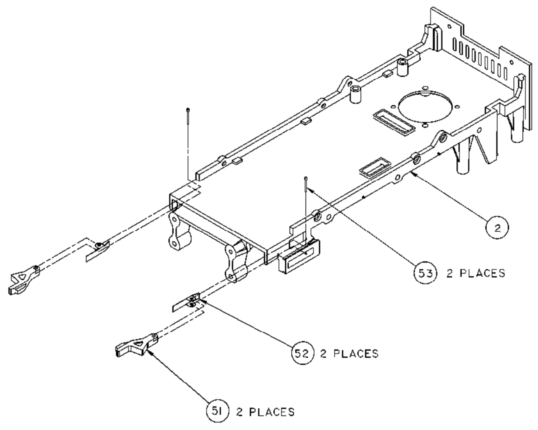
1 of 2


23 REF
3 REF
PLACE ITEM 23 APPROXIMATELY AS SHOWN.
DETAIL "A" REAR VIEW ITEM 3
1
42 SEE BACK VIEW FOR LOCATION
26 3 PLACES
BACK VIEW
75 SEE NOTE 5
17 REF
21 MARK LABEL WITH "TRAM 200SL" AND APPROPRIATE SERIAL NUMBER.
78
REF 72
REF 42 ONE PLACE
REF 70
FOLD OVER EDGE OF ITEM 4 AS SHOWN.
37 REF
4 REF
77 REF
.03 REF
DETAIL E BOTTOM VIEW ITEM 4
15 REF
76 REF
.13
.08
DETAIL F (BOTTOM VIEW OF ITEM 15)
(LOCATE APPROXIMATELY AS SHOWN)
71
23 7 FINGERS SEE DETAIL A
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
70
21
67
17
2 REF SEE DETAIL B
80 SEE NOTE 1
79
19 2 PLACES
54
10
34 2 PLACES
28 2 PLACES, TORQUE TO 6-7 IN/LBS TIGHTEN FIRST
20 4 PLACES
37
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
26 4 PLACES
77 SEE DETAIL E
3
37
5
7
2 PLACES 25
2 PLACES 29
33
A2 12
13 SEE DETAIL F
47 REF SEE NOTE 2
14
73
16
2 PLACES 26
36 PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
2 PLACES 27
41 2 PLACES
26 2 PLACES
2 PLACES 72
2 PLACES 30
15
76 SEE DETAIL F
40 SEE NOTE 3
9
44 1 FINGER
23
47 SEE NOTE 2
39 2 PLACES
SEE DETAIL D
1.50 LG. 61
TO BACK OF DAS MODULE
PART OF ITEM 47 TORQUE TO 7-8 IN/LB
69
SEE DETAIL C
74
22
68
8

2 of 2

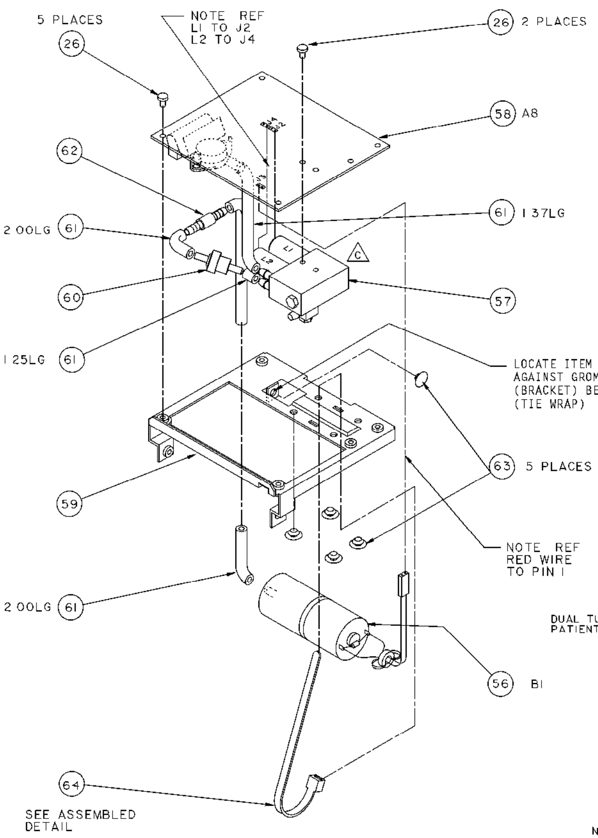

50
2 PLACES
48
2 PLACES
6

DETAIL C


2
53
2 PLACES
52
2 PLACES
51
2 PLACES

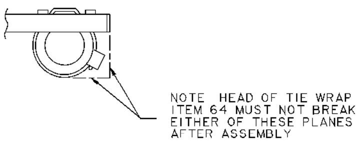
DETAIL B

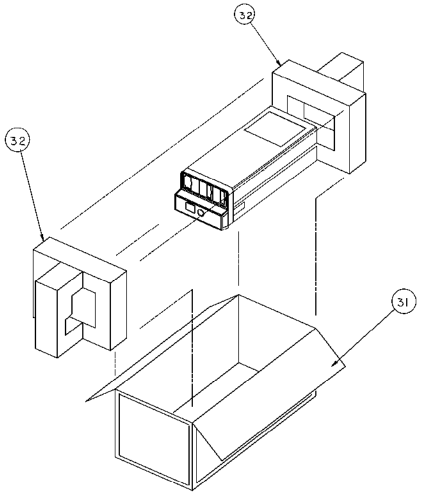
NOTES;
1. INSERT LONGER PIN SIDE INTO ITEM 12. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 12 WHEN ASSEMBLED.
1. PULSE OXIMETRY CABLE ITEM 47 TO BE ROUTED TO THE INSIDE OF FIRST STANDOFF ON ITEM 13, THEN BEHIND NON-ISO INPUT PCB (ITEM 30) FLEX CIRCUIT CONNECTOR AND LASTLY TO THE INSIDE OF SECOND STANDOFF ON ITEM 13.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. SWITCH SETTING MUST BE MADE FOR EACH CONFIGURATION. SEE PRODUCT LEVEL NOTE. (REFER TO SWITCH CHART)
5. MARK LABEL ITEM 75, AS FOLLOWS:
   ZULASSUNGSKENNZEICHEN: 01/M-305/94.
6. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
7. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.

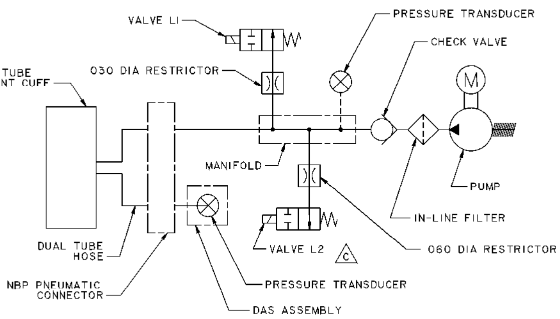

5 PLACES
26
NOTE REF
L1 TO J2
L2 TO J4
26
2 PLACES
58
A8
62
2 00LG
61
61
1 37LG
60
57
C
1 25LG
61
LOCATE ITEM 56 (PUMP) AGAINST GROMMET ON ITEM 59 (BRACKET) BEFORING ITEM 64 (TIE WRAP)
63
5 PLACES
59
NOTE REF
RED WIRE
TO PIN 1
2 00LG
61
56
B1
64
SEE ASSEMBLED DETAIL

DETAIL D

ASSEMBLED DETAIL


NOTE HEAD OF TIE WRAP ITEM 64 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY



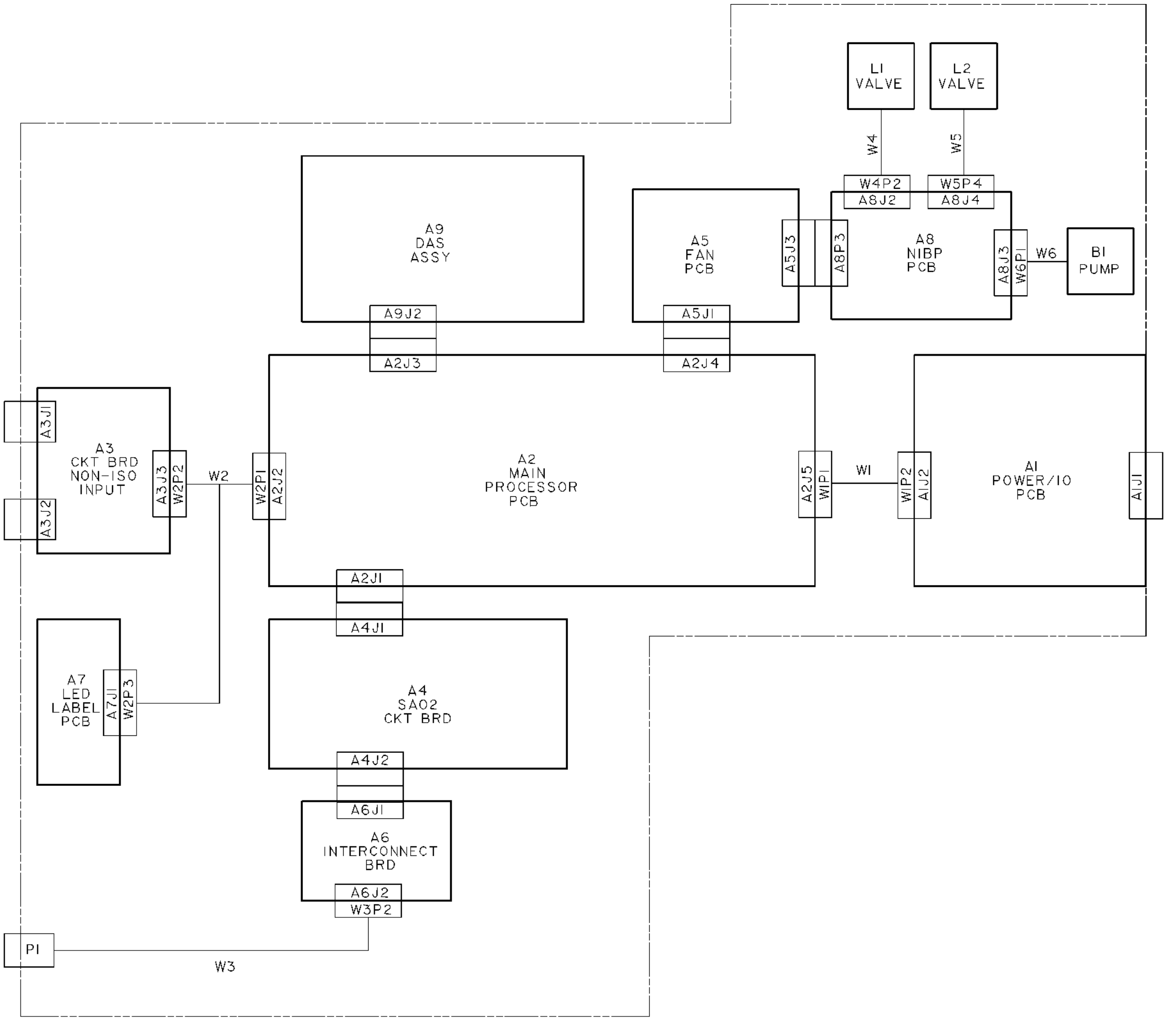

VALVE L1
PRESSURE TRANSDUCER
CHECK VALVE
DUAL TUBE PATIENT CUFF
030 DIA RESTRICTOR
M
MANIFOLD
PUMP
IN-LINE FILTER
VALVE L2
C
060 DIA RESTRICTOR
DUAL TUBE HOSE
NBP PNEUMATIC CONNECTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY

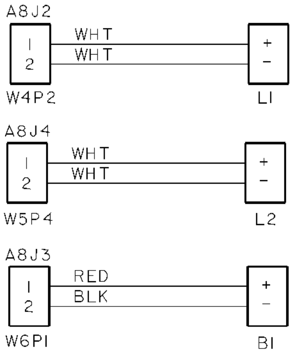
PNEUMATIC SCHEMATIC

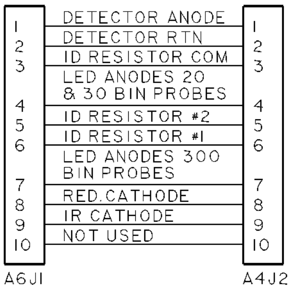
LEAD IDENT	ITEM NO	FROM	TO
W6	56	W6P1	A8J3
W4	57	W4P2	A8J2
W5	57	W5P4	A8J4

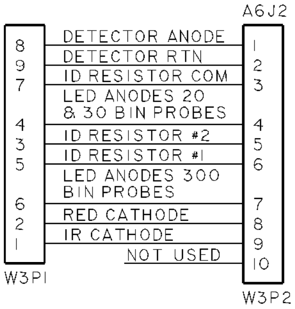
Schematic Diagram PN 411160-001H

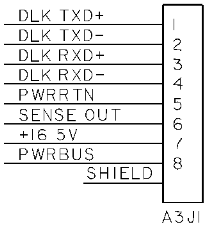
1 of 2

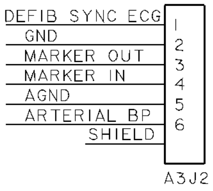

L1 VALVE
L2 VALVE
W4
W5
W4P2
A8J2
W5P4
A8J4
A9 DAS ASSY
A5 FAN PCB
A5J3
A8P3
A8 NIBP PCB
A8J3
W6P1
W6
B1 PUMP
A9J2
A2J3
A5J1
A2J4
A3J1
A3 CKT BRD NON-ISO INPUT
A3J2
A3J3
W2P2
W2
W2P1
A2J2
A2 MAIN PROCESSOR PCB
A2J5
W1P1
W1
W1P2
A1J2
A1 POWER/IO PCB
A1J1
A2J1
A4J1
A7 LED LABEL PCB
A7J1
W2P3
A4 SAO2 CKT BRD
A4J2
A6J1
A6 INTERCONNECT BRD
A6J2
W3P2
P1
W3


A8J2
1
2
WHT
WHT
+
−
W4P2
L1
A8J4
1
2
WHT
WHT
+
−
W5P4
L2
A8J3
1
2
RED
BLK
+
−
W6P1
B1


1 DETECTOR ANODE 1
2 DETECTOR RTN 2
3 ID RESISTOR COM 3
4 LED ANODES 20 & 30 BIN PROBES 4
5 ID RESISTOR #2 5
6 ID RESISTOR #1 6
7 LED ANODES 300 BIN PROBES 7
8 RED.CATHODE 8
9 IR CATHODE 9
10 NOT USED 10
A6J1
A4J2


A6J2
8 DETECTOR ANODE 1
9 DETECTOR RTN 2
7 ID RESISTOR COM 3
4 LED ANODES 20 & 30 BIN PROBES 4
3 ID RESISTOR #2 5
5 ID RESISTOR #1 6
6 LED ANODES 300 BIN PROBES 7
2 RED CATHODE 8
1 IR CATHODE 9
NOT USED 10
W3P1
W3P2


DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16 5V 7
PWRBUS 8
SHIELD
A3J1


DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2

2 of 2

	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD DATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBUS	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J4		A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A2J5 (W1P1)		A1J2 (W1P2)
1	ART BP	1
	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
1	+12 8 ANALOG	15
1	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40

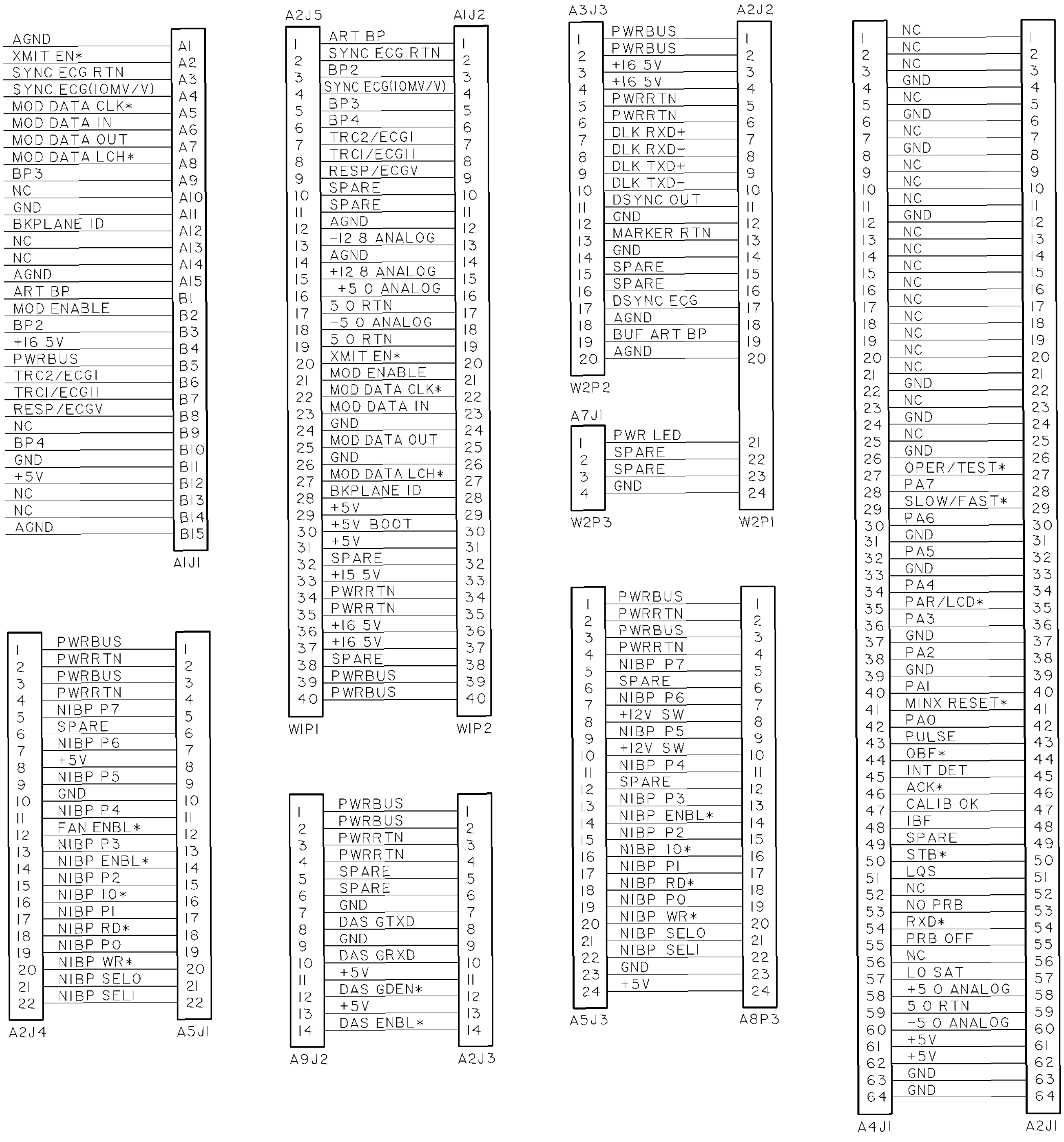
A9J2		A2J3
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A3J3 (W2P2) / A7J1 (W2P3)		A2J2 (W2P1)
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24

A5J3		A8P3
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+12V SW	8
9	NIBP P5	9
10	+12V SW	10
11	NIBP P4	11
12	SPARE	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
23	GND	23
24	+5V	24

A4J1		A2J1
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64

2 of 2



Signal	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD DATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBUS	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J5 (W1P1)	Signal	A1J2 (W1P2)
1	ART BP	1
2	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	9
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
15	+12 8 ANALOG	15
16	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40

A3J3 (W2P2)	Signal	A2J2 (W2P1)
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20

A7J1 (W2P3)	Signal	A2J2 (W2P1)
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24

A2J4	Signal	A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A9J2	Signal	A2J3
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A5J3	Signal	A8P3
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+12V SW	8
9	NIBP P5	9
10	+12V SW	10
11	NIBP P4	11
12	SPARE	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
23	GND	23
24	+5V	24

A4J1	Signal	A2J1
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64

Parts List PN 411160-001H

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3		Shield, Top	401679-001	1
4		Shield, Bottom	401679-002	1
5	A9	200 Acquisition Module, 10-Lead	417120-001	1
6		Front Bezel, Lower	401105-004	1
7	A5	Fan PCB	403549-002	1
8		Trim, Rubber, Front Bezel	404620-001	1
9		Mounting Strap, Trim	404621-001	1
10	A1	Power Supply PCB	401309-002	1
12	A2	Module Processor PCB	800210-005	1
13		Circuit Board/Bezel Mount	404672-001	1
14		Shield, Pulse Oximetry PCB	401680-001	1
15		Plate, Chassis Ground, Bottom/Front	402317-001	1
16	A4	Pulse Oximetry PCB	401189-001	1
17		Plate, Chassis Ground, Rear	404680-002	1
19		Spring, Compression	402315-001	2
20		Screw, Power Supply PCB Mounting, SST, 4-40	402214-001	4
21		Label, Model/Serial Number	404525-006	1
22	A7	Power Indicator PCB	403170-008	1
23		Spring, Chassis Ground, Rear	403741-001	AR
24		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
25		Nut, Hex, 4-40	4521-304	2
26		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	17
27		Screw, BDGH, Phillips, 4-40 x 1-3/8	45074-438	2
28		Spacer, Male/Female, 4-40 x 0.875	4656-414	2
29		Screw, 4-40 x 7/8	404069-001	2
30	A3, W2	Non-Isolated Input PCB	401315-002	1
31		Carton, Shipping	404211-003	1
32		Foam Insert	404211-004	2
33		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
34		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
36	A6	Interconnect PCB	800006-001	1
37		Insulator, Bottom Shield	404188-001	2
39		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
40		Washer, Pulse Oximetry Connector	4550-250	1
41		Screw, FLH, Phillips, SST, 4-40 x 3/8	4505-412	2
42		Screw, PNH, 4-40 x 0.188, Modified (Determined by Destination)	409009-001	1
42		Screw, BDGH, 4-40 x 0.188 (Determined by Destination)	45075-406	1

Item	Reference Designation	Parts List	Part Number	Qty
43		Tram 100 - 850 A and SL Module Service Manual	404422-065	–
44		Adhesive, Diecut, Right Front	415098-001	AR
47	W3	Harness Assembly, SpO2 – w/Choke	700091-004	1
48		Pin, Latch	402806-001	2
50		Button, Latch	402106-001	2
51		Latch	401682-001	2
52		Spring, Latch	406019-001	2
53		Pin, Latch	406037-001	2
54		Bracket, Power Supply PCB	406254-001	1
56	B1, W6	Pump Assembly, NBP, w/Harness	408169-002	1
57	V1, V2, W4, W5	NBP Valve Assembly	416153-001	1
58	A8	NBP PCB	800316-002	1
59		Bracket, NBP Mounting	404296-001	1
60		Check Valve, 0.125 ID	404675-001	1
61		Tubing, Silastic	401582-001	AR
62		Filter, 43 Micron	404679-001	1
63		Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness	404749-001	5
64		Tie Wrap	4535-002	1
67		Label, TUV (Determined by Destination)	408103-003	1
67		Label, UL (Determined by Destination)	408230-001	1
68		Label, Front, 200SL, English (Determined by Destination)	411173-002	1
68		Label, Front, 200SL, German (Determined by Destination)	411173-003	1
68		Label, Front, 200SL, French (Determined by Destination)	411173-004	1
68		Label, Front, 200SL, Swedish (Determined by Destination)	411173-005	1
68		Label, Front, 200SL, Spanish (Determined by Destination)	411173-006	1
68		Label, Front, 200SL, Italian (Determined by Destination)	411173-007	1
69		Label, Top, English (Determined by Destination)	411173-009	1
69		Label, Top, German (Determined by Destination)	411173-010	1
69		Label, Top, French (Determined by Destination)	411173-011	1
69		Label, Top, Swedish (Determined by Destination)	411173-012	1
69		Label, Top, Spanish (Determined by Destination)	411173-013	1
69		Label, Top, Italian (Determined by Destination)	411173-014	1
71		Label, Cover, English (Determined by Destination)	411173-016	1
71		Label, Cover, German (Determined by Destination)	411173-020	1
71		Label, Cover, French (Determined by Destination)	411173-021	1
71		Label, Cover, Swedish (Determined by Destination)	411173-022	1
71		Label, Cover, Spanish (Determined by Destination)	411173-023	1
71		Label, Cover, French (Determined by Destination)	411173-024	1

Item	Reference Designation	Parts List	Part Number	Qty
71		Label, Cover, International (Determined by Destination)	411173-025	1
72		Screw, PNH, Phillips, SST, 4-40 x 3/16	4502-406	2
73	P1	Connector, Header, 64-Pin, w/Ferrites	409203-001	1
74		Adhesive, Diecut, Front Left	415098-002	1
76		Spring, Chassis Ground, Small	414610-001	AR
77		Adhesive, Mylar	415316-001	1
78		Label, CE Mark	408230-008	1
79		PC Post, 2 x 7	412062-004	1
80		PC Post, 2 x 11	412062-005	1

Assembly Revisions PN 411160

The baseline revision for this assembly is pn 411160-001G. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 411160-001A

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 200 Module, 10-Lead	411166-001	417120-001	1
11		Label Set, Tram 200SL	411173-001	Not Used	1
12		Module Processor PCB	800210-002	800210-005	1
42		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
46		Bezel Kit, Front	407721-004	Not Used	1
57	V1, V2, W4, W5	NBP Tram Valve Assembly	404459-001	416153-001	1
58	A8	NBP PCB	800316-001	800316-002	1
72		Screw, Phillips, STT, 4-40 x 3/16	Not Used	4502-406	2
73		Connector, Header 64-pin w/Ferrites	Not Used	409203-001	1
74		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411160-001B

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 200 Module, 10-Lead	411166-001	417120-001	1
11		Label Set, Tram 200SL	411173-001	Not Used	1
12		Module Processor PCB	800210-002	800210-005	1
42		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
46		Bezel Kit, Front	407721-004	Not Used	1
57	V1, V2, W4, W5	NBP Valve Assembly	413021-001	416153-001	1
58	A8	NBP PCB	800316-001	800316-002	1
72		Screw, Phillips, STT, 4-40 x 3/16	Not Used	4502-406	2
73		Connector, Header 64-pin w/Ferrites	Not Used	409203-001	1
74		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411160-001C

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 200 Module, 10-Lead	411166-001	417120-001	1
12		Module Processor PCB	800210-002	800210-005	1
42		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
57	V1, V2, W4, W5	NBP Valve Assembly	413021-001	416153-001	1
58	A8	NBP PCB	800316-001	800316-002	1
74		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411160-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 411160-001C for changes to the parts list.

PN 411160-001E

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 200 Module, 10-Lead	411166-001	417120-001	1
12		Module Processor PCB	800210-002	800210-005	1
57	V1, V2, W4, W5	NBP Valve Assembly	413021-001	416153-001	1
58	A8	NBP PCB	800316-001	800316-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411160-001F

This revision was a documentation change that does not affect this manual.
Refer to pn 411160-001E for changes to the parts list.

PN 411160-001G

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 200 Module, 10-Lead	411166-001	417120-001	1
57	V1, V2, W4, W5	NBP Valve Assembly	413021-001	416153-001	1
58	A8	NBP PCB	800316-001	800316-002	1

9

TRAM 250SL MODULE PN 412651

General **9-2**
  Circuit Boards 9-2

Exploded View PN 412651-001H **9-3**

Schematic Diagram PN 412651-001H **9-5**

Parts List PN 412651-001H **9-7**

Assembly Revisions PN 412651 .... **9-10**

General

Circuit Boards

Details about the circuit boards contained in the Tram 250SL are discussed in later chapters arranged by part number.

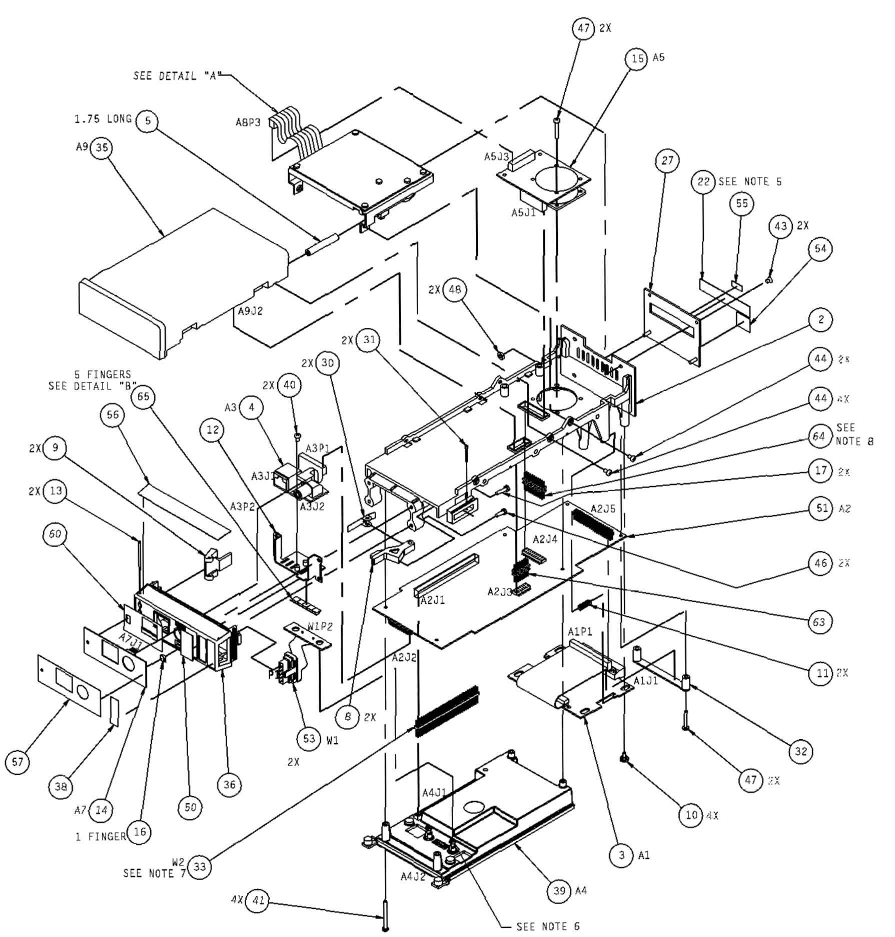
Table 8-1. Circuit Board Overview

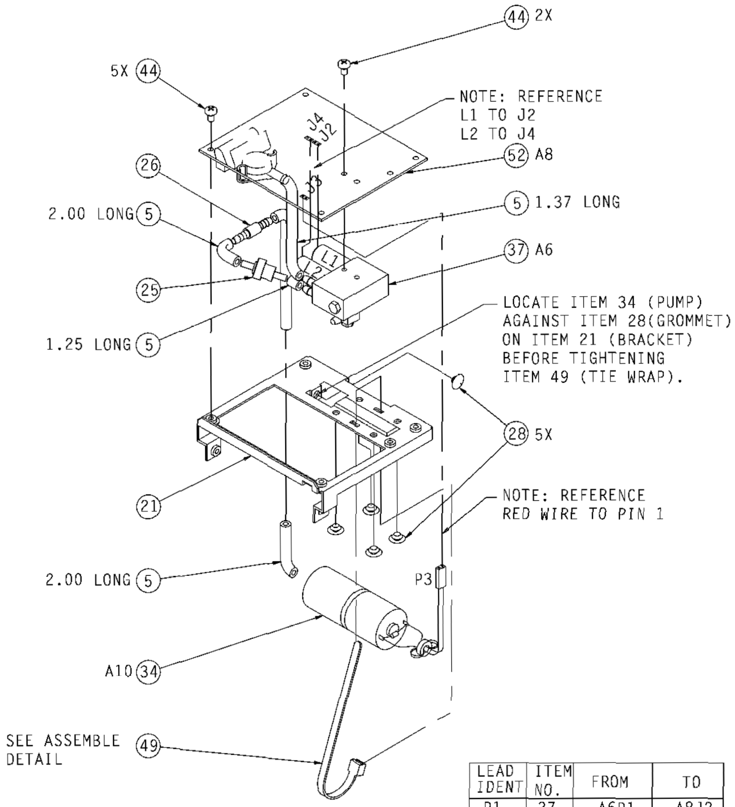
Module Type	Upper Level	Leadwire Configuration	DAS Module	Acquisition Processor PCB	Module Processor PCB
Tram 250SL	412651-001A–G	10-Leadwire	411166-001	800330-006	800210-005
Tram 250SL	412651-001H	10-Leadwire	417120-001 (Replaced 411166-001)	801040-001	800210-005

Exploded View

PN 412651-001H

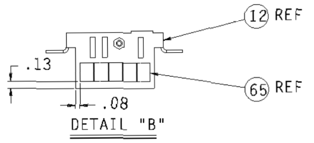
1 of 2


47 2X
15 A5
SEE DETAIL "A"
1.75 LONG 5
A8P3
A9 35
A5J3
A5J1
27
22 SEE NOTE 5
55
43 2X
54
2
44 2X
44 4X
64 SEE NOTE 8
17 2X
51 A2
46 2X
63
11 2X
32
47 2X
10 4X
3 A1
39 A4
SEE NOTE 6
A9J2
2X 48
2X 31
2X 30
5 FINGERS SEE DETAIL "B"
65
2X 40
A3 4
12
56
2X 9
2X 13
60
A3P1
A3J1
A3J2
A3P2
A2J5
A2J4
A2J3
A2J1
A2J2
A1P1
A1J1
W1P2
A7J1
8 2X
53 W1
2X
A4J1
A4J2
57
38
A7 14
50
36
1 FINGER 16
W2 SEE NOTE 7 33
4X 41


44 2X
5X 44
NOTE: REFERENCE
L1 TO J2
L2 TO J4
J4
J2
L1
52 A8
26
5 1.37 LONG
2.00 LONG 5
37 A6
25
LOCATE ITEM 34 (PUMP) AGAINST ITEM 28(GROMMET) ON ITEM 21 (BRACKET) BEFORE TIGHTENING ITEM 49 (TIE WRAP).
1.25 LONG 5
28 5X
21
NOTE: REFERENCE RED WIRE TO PIN 1
2.00 LONG 5
P3
A10 34
SEE ASSEMBLE DETAIL 49

LEAD IDENT	ITEM NO.	FROM	TO
P1	37	A6P1	A8J2
P2	37	A6P2	A8J4
P3	34	A10P3	A8J3

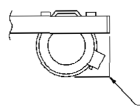
DETAIL "A"


12 REF
65 REF
.13
.08

DETAIL "B"

(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 12)

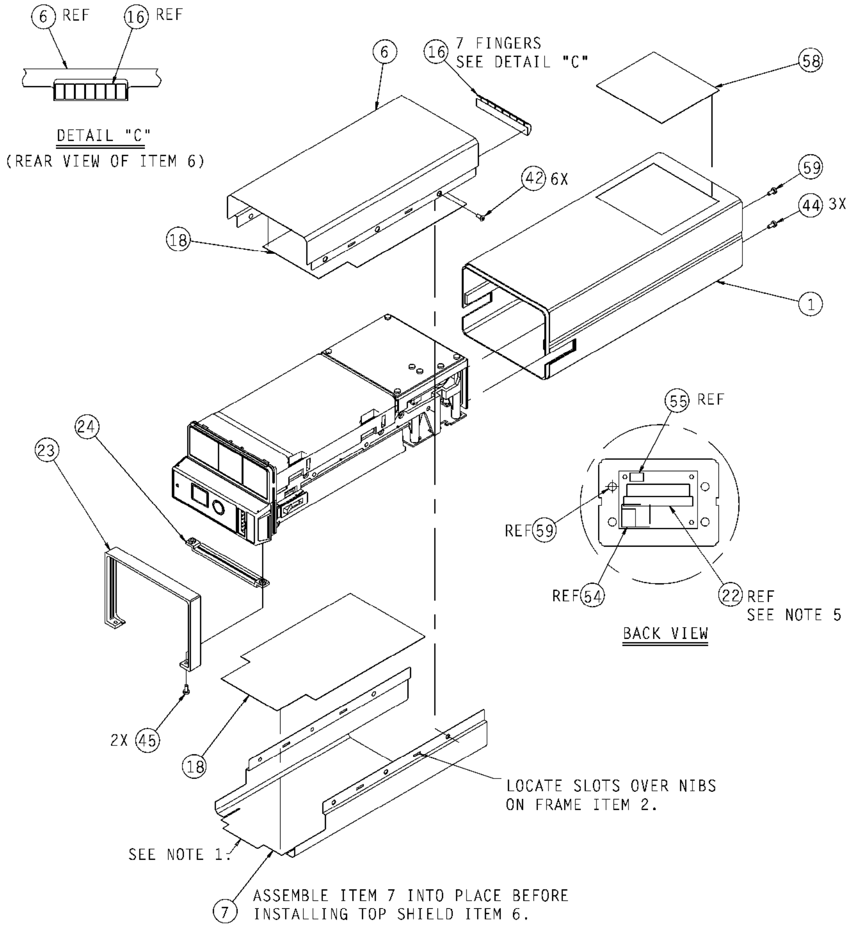
NOTES:
1. *WHEN SHIELD (ITEM 7) IS INSTALLED, THE TAB SHOULD TUCK INTO THE* FRONT BEZEL (ITEM 36) AND BE IN CONTACT WITH THE SHIELDING FINGERS (ITEM 16) ON THE BOTTOM OF THE BRACKET (ITEM 12).
2. SWITCH SETTINGS MUST BE MADE FOR EACH CONFIGURATION (SEE SWITCH CHART SHEET 2).
3. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
4. *LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND* SHIPPED SEPARATELY.
5. MARK LABEL WITH MODEL NUMBER, SERIAL NUMBER, AND BAR CODE.
6. INSERT TWO HOLES OF FLEX PCB (ITEM 53) ONTO 1/4-TURN STANDOFF (ITEM 39) UNTIL CONNECTOR ON PCB FLEX BOTTOMS OUT. THEN LOCK THE STANDOFFS BY TURNING THE HEX SCREW OF THE STANDOFF 1/4-TURN CLOCKWISE.
7. INSERT THE SHORT LEADS OF CONNECTOR (ITEM 33) INTO PCB TRAM CPU (ITEM 51).
8. INSERT LONGER PIN SIDE INTO ITEM 51. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 51 WHEN ASSEMBLED.

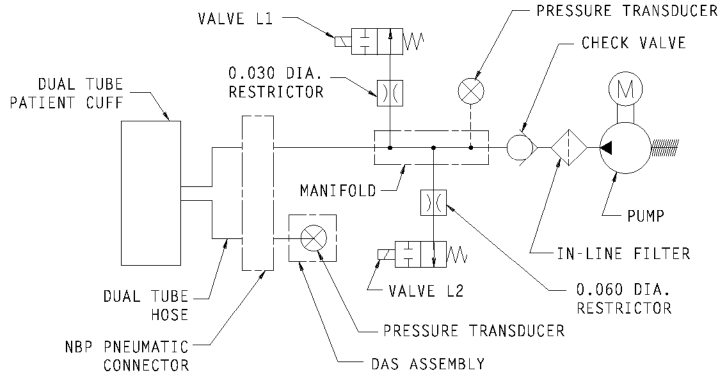


ASSEMBLED DETAIL

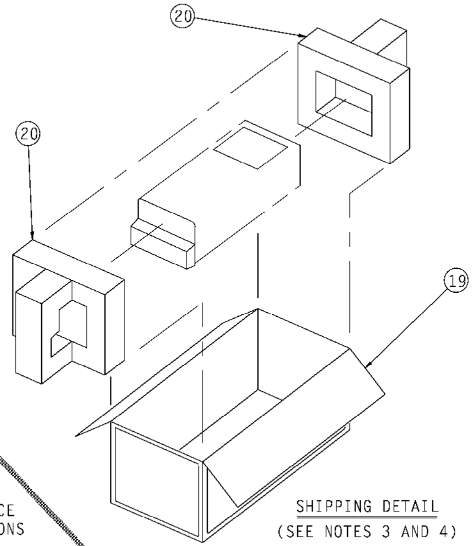
NOTE: HEAD OF TIE WRAP ITEM 49 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY.

2 of 2


6 REF
16 REF
DETAIL "C"
(REAR VIEW OF ITEM 6)
6
16 7 FINGERS SEE DETAIL "C"
58
42 6X
59
44 3X
18
1
55 REF
REF 59
REF 54
22 REF SEE NOTE 5
BACK VIEW
23
24
2X 45
18
LOCATE SLOTS OVER NIBS ON FRAME ITEM 2.
SEE NOTE 1.
7 ASSEMBLE ITEM 7 INTO PLACE BEFORE INSTALLING TOP SHIELD ITEM 6.


VALVE L1
0.030 DIA. RESTRICTOR
PRESSURE TRANSDUCER
CHECK VALVE
M
DUAL TUBE PATIENT CUFF
MANIFOLD
PUMP
IN-LINE FILTER
VALVE L2
0.060 DIA. RESTRICTOR
DUAL TUBE HOSE
NBP PNEUMATIC CONNECTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY

PNEUMATIC SCHEMATIC

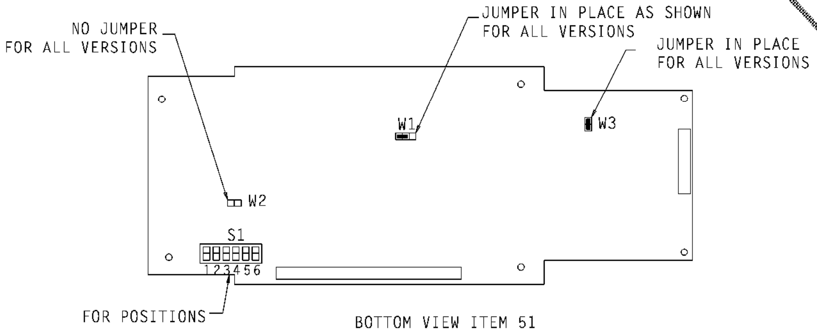


SHIPPING DETAIL
(SEE NOTES 3 AND 4)

SWITCH CHART
(SEE NOTE 2)

▀ =ON
▄ =OFF

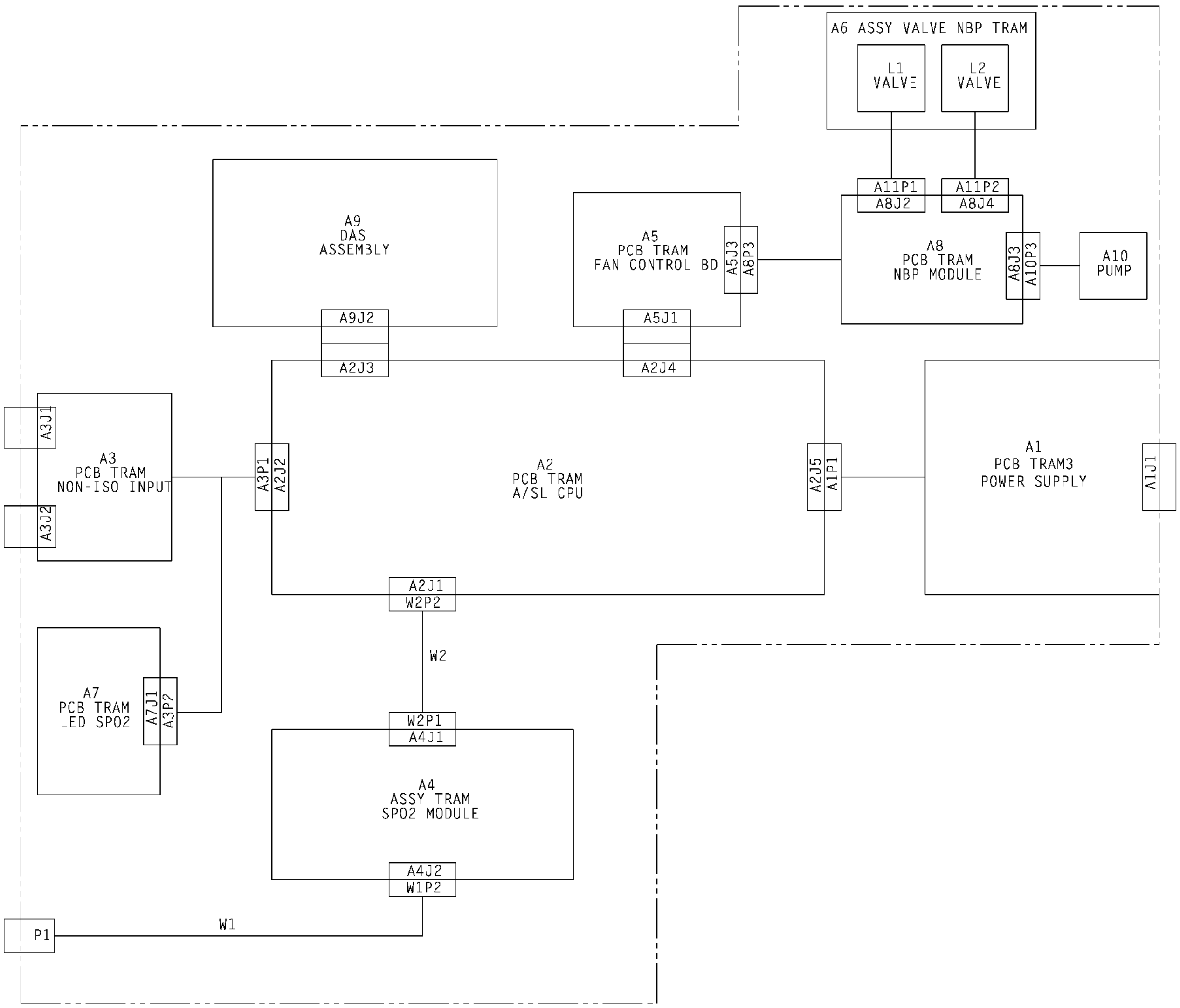
DESCRIPTION	SW1 (123456)	OMAR NUMBER	
ENG 60HZ	▄▄▄▄▄▄	T250 T450 T850 T850SL	=A,G
ENG 50HZ	▄▄▄▄▄▀	T250 T450 T850 T850SL	=A5
SI 60HZ	▄▄▄▄▀▄	T250 T450 T850 T850SL	=Q
SI 50HZ	▄▄▄▄▀▀	T250 T450 T850 T850SL	=S,H, T,J, P,W

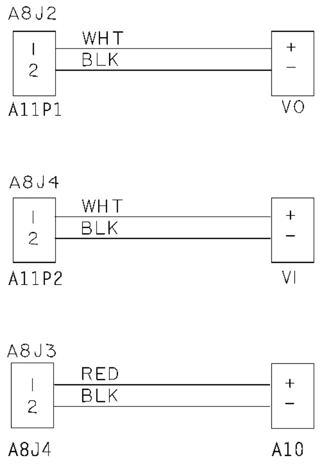

NO JUMPER FOR ALL VERSIONS
JUMPER IN PLACE AS SHOWN FOR ALL VERSIONS
JUMPER IN PLACE FOR ALL VERSIONS
W1
W3
W2
S1
123456
FOR POSITIONS SEE SWITCH CHART

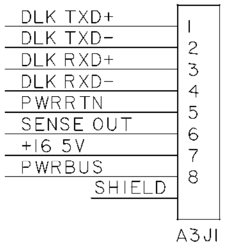
BOTTOM VIEW ITEM 51

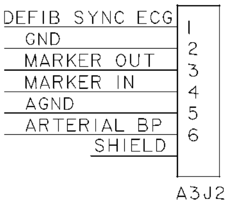
Schematic Diagram PN 412651-001H

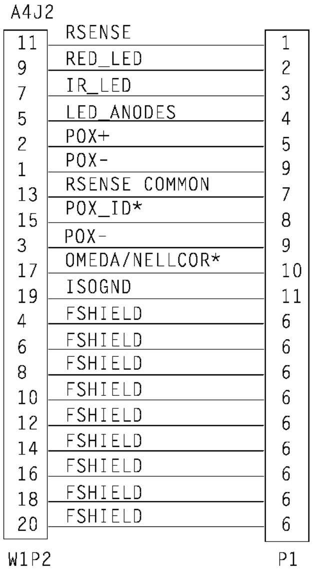
1 of 2


A6 ASSY VALVE NBP TRAM
L1 VALVE
L2 VALVE
A11P1
A8J2
A11P2
A8J4
A9 DAS ASSEMBLY
A9J2
A2J3
A5 PCB TRAM FAN CONTROL BD
A5J3
A8P3
A5J1
A2J4
A8 PCB TRAM NBP MODULE
A8J3
A10P3
A10 PUMP
A3J1
A3 PCB TRAM NON-ISO INPUT
A3J2
A3P1
A2J2
A2 PCB TRAM A/SL CPU
A2J5
A1P1
A1 PCB TRAM3 POWER SUPPLY
A1J1
A2J1
W2P2
W2
W2P1
A4J1
A7 PCB TRAM LED SPO2
A7J1
A3P2
A4 ASSY TRAM SPO2 MODULE
A4J2
W1P2
P1
W1


A8J2
1
2
WHT
BLK
+
−
A11P1
VO
A8J4
1
2
WHT
BLK
+
−
A11P2
VI
A8J3
1
2
RED
BLK
+
−
A8J4
A10


DLK TXD+
DLK TXD-
DLK RXD+
DLK RXD-
PWRRTN
SENSE OUT
+16 5V
PWRBUS
SHIELD
1
2
3
4
5
6
7
8
A3J1


DEFIB SYNC ECG
GND
MARKER OUT
MARKER IN
AGND
ARTERIAL BP
SHIELD
1
2
3
4
5
6
A3J2



A4J2

W1P2		P1
11	RSENSE	1
9	RED_LED	2
7	IR_LED	3
5	LED_ANODES	4
2	POX+	5
1	POX-	9
13	RSENSE COMMON	7
15	POX_ID*	8
3	POX-	9
17	OMEDA/NELLCOR*	10
19	ISOGND	11
4	FSHIELD	6
6	FSHIELD	6
8	FSHIELD	6
10	FSHIELD	6
12	FSHIELD	6
14	FSHIELD	6
16	FSHIELD	6
18	FSHIELD	6
20	FSHIELD	6

2 of 2

	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD ATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBU	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J5 (A1P1)		A1J2
1	ART BP	1
2	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	9
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
15	+12 8 ANALOG	15
16	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40

A3J3 (W2P2)		A2J2 (W2P1)
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20

A7J1 (A3P1)		A2J2 (W2P1)
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24

A2J4		A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A9J2		A2J3
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A5J3		A8P3
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+12V SW	8
9	NIBP P5	9
10	+12V SW	10
11	NIBP P4	11
12	SPARE	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
23	GND	23
24	+5V	24

A4J1 (W2P1)		A2J1 (W2P2)
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64

Parts List PN 412651-001H

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3	A1	Power Supply PCB	401309-002	1
4	A3	Non-Isolated Input PCB	401315-002	1
5		Tubing, Silastic	401582-001	AR
6		Shield, Top	401679-001	1
7		Shield, Bottom	401679-002	1
8		Latch	401682-001	2
9		Button, Latch	402106-001	2
10		Screw, Shoulder	402214-001	4
11		Spring, Compression	402315-001	2
12		Plate, Chassis Ground, Bottom/Front	402317-001	1
13		Pin, Latch	402806-001	2
14	A7	Power Indicator PCB	403170-011	1
15	A5	Fan PCB	403549-002	1
16		Spring, Chassis Ground, Rear	403741-001	AR
17		Screw, BDGH, Phillips, 4-40 x 7/8	404069-001	2
18		Insulator, Bottom Shield	404188-001	2
19		Carton, Shipping	404211-003	1
20		Foam, Insert	404211-004	
21		Bracket, NBP Mounting	404296-001	1
22		Label, Blank	404525-006	1
23		Trim, Rubber, Front Bezel	404620-001	1
24		Mounting Strap, Trim	404621-001	1
25		Check Valve, 0.125 ID	404675-001	1
26		Filter, 43 Micron	404679-001	1
27		Plate, Chassis Ground, Rear	404680-002	1
28		Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness	404749-001	5
30		Spring, Latch	406019-001	2
31		Pin, Latch	406037-001	2
32		Bracket, Power Supply PCB	406254-001	1
33	W2	Connector, Header, Dual, 64-Pin	407452-002	1
34	A10	Pump Assembly, NBP, w/Harness	408169-002	1
35	A9	200 Acquisition Module, 10-Lead	417120-001	1
36		Front Bezel, Tram	412659-001	1
37	A6	NBP Valve Assembly	416153-001	1
38		Label, Pulse Oximetry, Nellcor	413831-002	1
39	A4	Pulse Oximetry Assembly (Including Pulse Oximetry PCB, PN 800674-00X)	414409-001	1
40		Screw, BDGH, Phillips, 4-40 x 3/16	4502-406	2
41		Screw, BDGH, Phillips, 4-40 x 1-1/4	4502-440	4

Item	Reference Designation	Parts List	Part Number	Qty
42		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
43		Screw, FLH, Phillips, SST, 4-40 x 3/8	4505-412	2
44		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	15
45		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
46		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
47		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
48		Nut, Hex, 4-40	4521-304	2
49		Tie Wrap	4535-002	1
50		Adhesive, Diecut, Front Right	415098-003	1
51	A2	Module Processor PCB	800210-005	1
52	A8	NPB PCB	800316-002	1
53	W1	Harness, Pulse Oximetry PCB-to-Connector	800892-001	1
54		Label, UL Listed	408230-002	1
55		Label, 60 Hertz	411091-018	1
55		Label, 50 Hertz	411091-019	1
56		Label, Top, English (Determined by Destination)	411173-009	1
56		Label, Top, German (Determined by Destination)	411173-010	1
56		Label, Top, French (Determined by Destination)	411173-011	1
56		Label, Top, Swedish (Determined by Destination)	411173-012	1
56		Label, Top, Spanish (Determined by Destination)	411173-013	1
56		Label, Top, Italian (Determined by Destination)	411173-014	1
57		Label, Front, 250SL, English (Determined by Destination)	413835-001	1
57		Label, Front, 250SL, German (Determined by Destination)	413835-002	1
57		Label, Front, 250SL, French (Determined by Destination)	413835-003	1
57		Label, Front, 250SL, Swedish (Determined by Destination)	413835-004	1
57		Label, Front, 250SL, Spanish (Determined by Destination)	413835-005	1
57		Label, Front, 250SL, Italian (Determined by Destination)	413835-006	1
57		Label, Front, 250SL, Dutch (Determined by Destination)	413835-007	1
58		Label, Cover, English (Determined by Destination)	414045-001	1
58		Label, Cover, German (Determined by Destination)	414045-002	1
58		Label, Cover, French (Determined by Destination)	414045-003	1
58		Label, Cover, Swedish (Determined by Destination)	414045-004	1
58		Label, Cover, Spanish (Determined by Destination)	414045-005	1
58		Label, Cover, Italian (Determined by Destination)	414045-006	1
58		Label, Cover, International (Determined by Destination)	414045-007	1
59		Spring, Chassis Ground, Small	414610-001	AR
59		Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination)	409009-001	1

Item	Reference Designation	Parts List	Part Number	Qty
59		Screw, PHD, 4-40 x 0.188 (Determined by Destination)	45074-406	1
60		Adhesive, Diecut, Front Left	415098-002	1
61		Tram 100 - 850 A and SL Module Service Manual	404422-065	1
62		Label, CE Mark	408230-008	1
63		PC Post, 2 x 7	412062-004	1
64		PC Post, 2 x 11	412062-005	1

Assembly Revisions PN 412651

The baseline revision for this assembly is pn 412651-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 412651-001A

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 200 Module, 10-Lead	411166-001	417120-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
51		Module Processor PCB	800210-002	800210-005	1
52	A8	NBP PCB	800316-001	800316-002	1
59		Spring, Chassis Ground, Small	Not Used	414610-001	AR
60		Adhesive, Front Diecut, Left	Not Used	415098-002	1
62		Label, CE Mark	Not Used	408230-008	1
63		PC Post, 2 x 7	Not Used	412062-004	1
64		PC Post, 2 x 11	Not Used	412062-005	1

PN 412651-001B

This revision was a documentation change that does not affect this manual.
Refer to pn 412651-001A for changes to the parts list.

PN 412651-001C

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 200 Module, 10-Lead	411166-001	417120-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
51		Module Processor PCB	800210-002	800210-005	1
52	A8	NBP PCB	800316-001	800316-002	1
62		Label, CE Mark	Not Used	408230-008	1
63		PC Post, 2 x 7	Not Used	412062-004	1
64		PC Post, 2 x 11	Not Used	412062-005	1

PN 412651-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 412651-001C for changes to the parts list.

PN 412651-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 412651-001C for changes to the parts list.

PN 412651-001F

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 200 Module, 10-Lead	411166-001	417120-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
52	A8	NBP PCB	800316-001	800316-002	1

PN 412651-001G

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 200 Module, 10-Lead	411166-001	417120-001	1
52	A8	NBP PCB	800316-001	800316-002	1

For your notes

10

TRAM 400A/SL MODULE PN 410496/411161

General **10-2**
  Circuit Boards 10-2

Exploded View PN 410496-001D **10-3**

Schematic Diagram PN 410496-001D **10-4**

Parts List PN 410496-001D **10-7**

Tram 400A Module Assembly Revisions **10-9**

Exploded View PN 411161-001J **10-10**

Schematic Diagram PN 411161-001J **10-12**

Parts List PN 411161-001J **10-14**

Assembly Revisions PN 411161 .... **10-17**

General

Circuit Boards

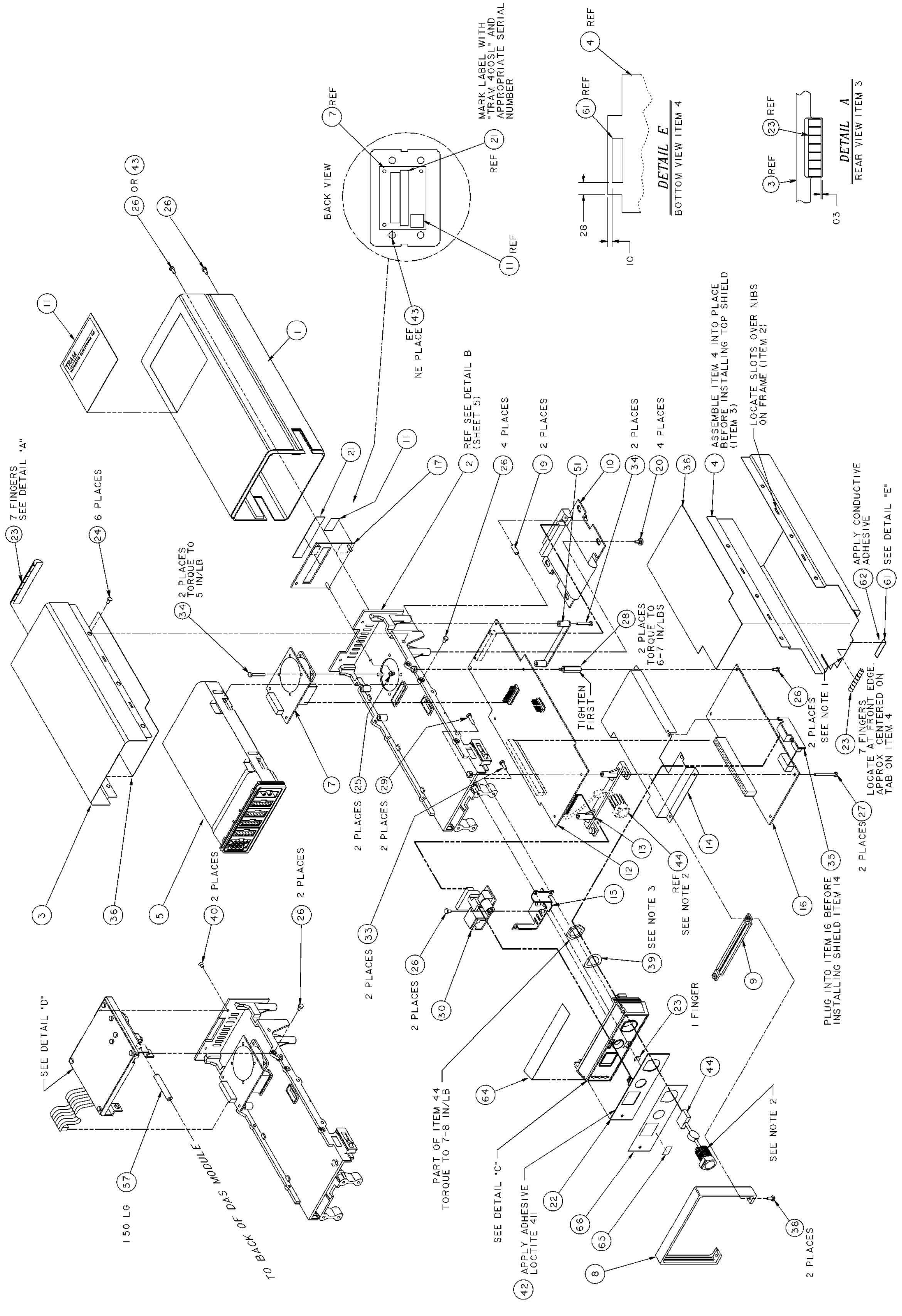
Details about the circuit boards contained in the Tram 400A/SL are discussed in later chapters arranged by part number.

Table 8-1. Circuit Board Overview

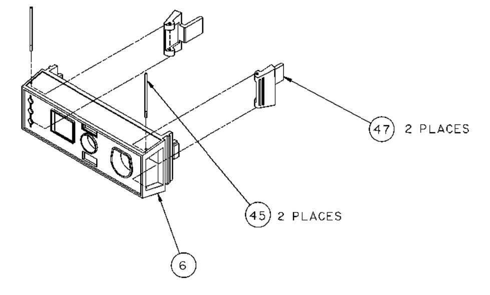
Module Type	Upper Level	Leadwire Configuration	DAS Module	Acquisition Processor PCB	Module Processor PCB
Tram 400A	410496-001A–C	5-Leadwire	410495-001	800330-009	800210-005
Tram 400SL	411161-001A–H	10-Leadwire	411167-001	800330-010	800210-005
Tram 400SL	411161-001J	10-Leadwire	417121-001 (Replaced 411167-001)	801040-001	800210-005

Exploded View PN 410496-001D

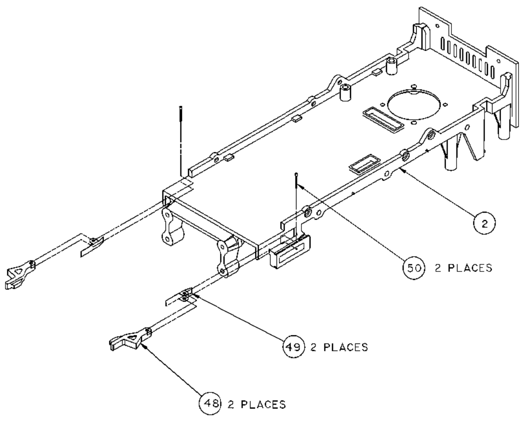
1 of 2


BACK VIEW
7 REF
MARK LABEL WITH "TRAM 400SL" AND APPROPRIATE SERIAL NUMBER
REF 21
11 REF
43 REF
ONE PLACE
26 OR 43
26
11
1
DETAIL E
BOTTOM VIEW ITEM 4
4 REF
61 REF
.28
.10
DETAIL A
REAR VIEW ITEM 3
3 REF
23 REF
.03
23 7 FINGERS SEE DETAIL "A"
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
21
11
17
2 REF SEE DETAIL B (SHEET 5)
26 4 PLACES
19 2 PLACES
51
10
34 2 PLACES
20 4 PLACES
36
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
62 APPLY CONDUCTIVE ADHESIVE
61 SEE DETAIL "E"
28 2 PLACES TORQUE TO 6-7 IN/LBS
TIGHTEN FIRST
26
2 PLACES SEE NOTE 1
23 7 FINGERS LOCATE AT FRONT EDGE. APPROX CENTERED ON TAB ON ITEM 4
27 2 PLACES
35 PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
16
14
44 REF SEE NOTE 2
13
12
15
39 SEE NOTE 3
9
7
25 2 PLACES
29 2 PLACES
3
36
5
40 2 PLACES
26 2 PLACES
33 2 PLACES
26 2 PLACES
30
23 1 FINGER
44
SEE NOTE 2
SEE DETAIL "D"
57
1.50 LG
TO BACK OF DAS MODULE
PART OF ITEM 44 TORQUE TO 7-8 IN/LB
64
SEE DETAIL "C"
22
42 APPLY ADHESIVE LOCTITE 411
66
65
8
38 2 PLACES

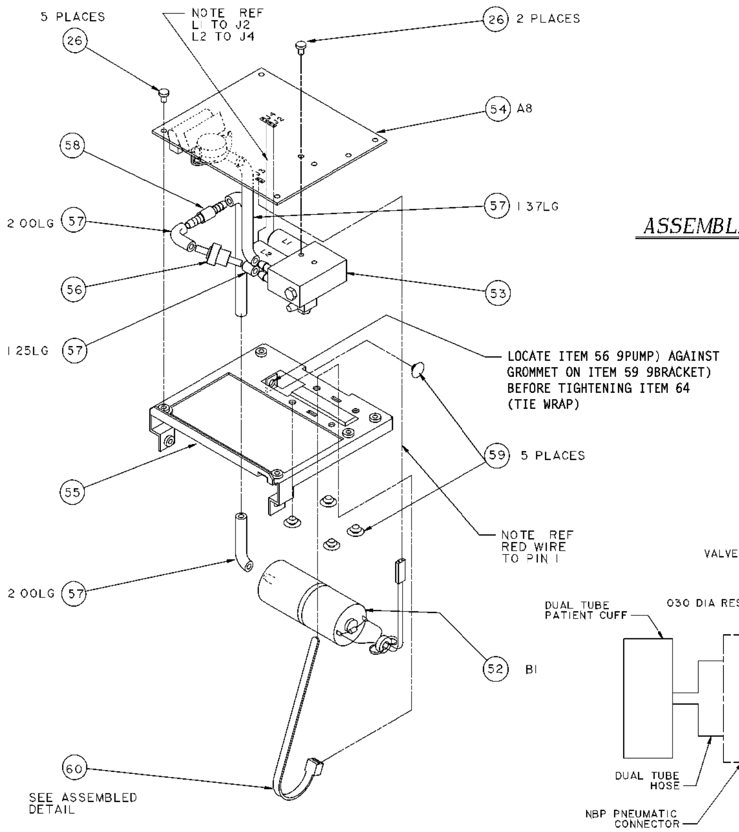
2 of 2


47
2 PLACES
45
2 PLACES
6

DETAIL C


2
50
2 PLACES
49
2 PLACES
48
2 PLACES

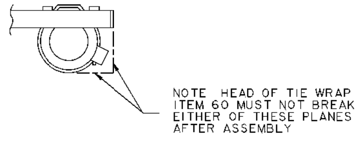
DETAIL B

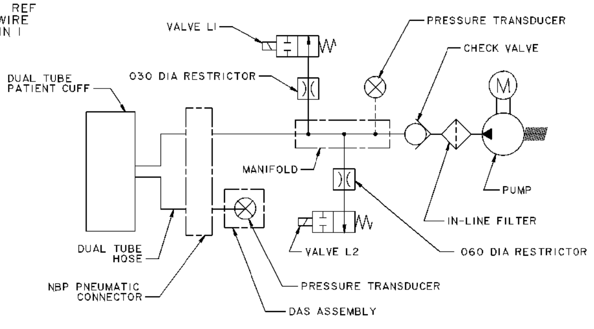

5 PLACES
26
NOTE REF
L1 TO J2
L2 TO J4
26
2 PLACES
54
A8
58
2 00LG
57
57
1 37LG
56
53
1 25LG
57
LOCATE ITEM 56 9PUMP) AGAINST
GROMMET ON ITEM 59 9BRACKET)
BEFORE TIGHTENING ITEM 64
(TIE WRAP)
59
5 PLACES
55
NOTE REF
RED WIRE
TO PIN 1
2 00LG
57
52
B1
60
SEE ASSEMBLED
DETAIL

DETAIL D

LEAD IDENT	ITEM NO	FROM	TO
W6	52	B1P1	A8J3
W4	53	W4P2	A8J2
W5	53	B1P3	A8J4

ASSEMBLED DETAIL

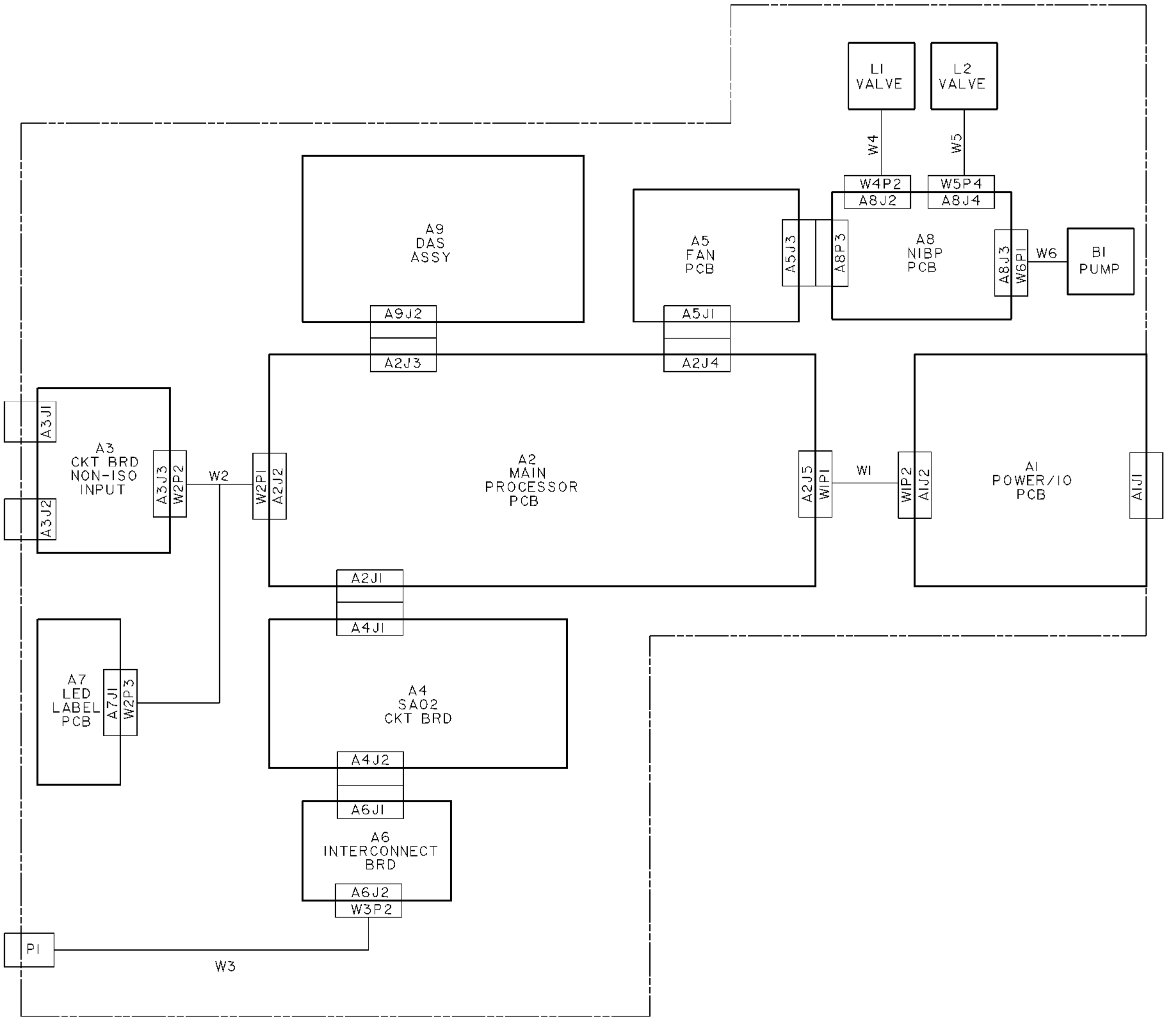

NOTE HEAD OF TIE WRAP
ITEM 60 MUST NOT BREAK
EITHER OF THESE PLANES
AFTER ASSEMBLY

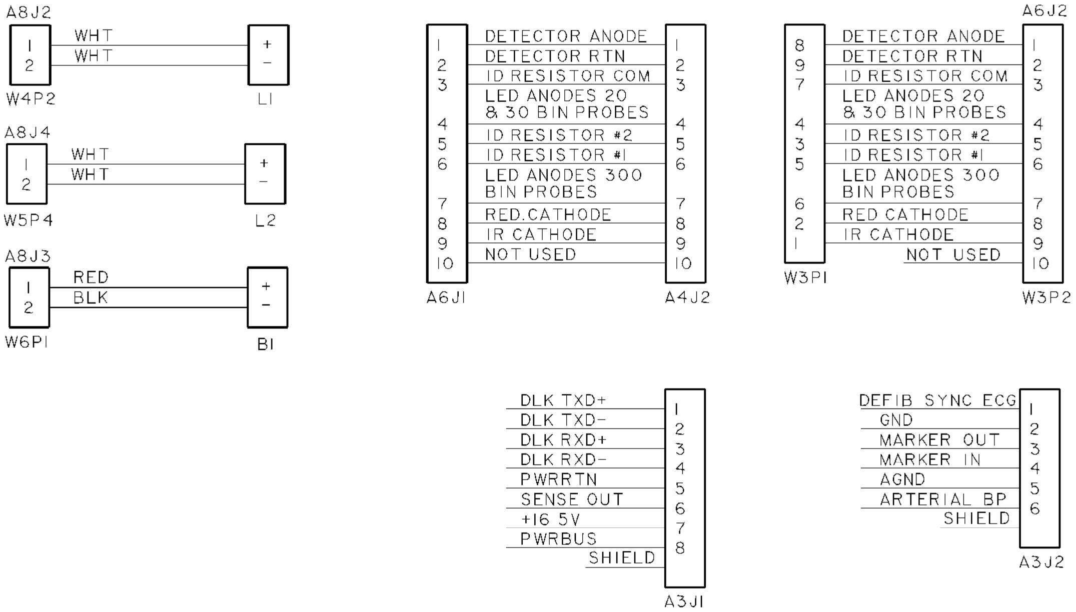

VALVE L1
PRESSURE TRANSDUCER
CHECK VALVE
030 DIA RESTRICTOR
DUAL TUBE
PATIENT CUFF
M
MANIFOLD
PUMP
IN-LINE FILTER
VALVE L2
060 DIA RESTRICTOR
DUAL TUBE
HOSE
PRESSURE TRANSDUCER
NBP PNEUMATIC
CONNECTOR
DAS ASSEMBLY

PNEUMATIC SCHEMATIC

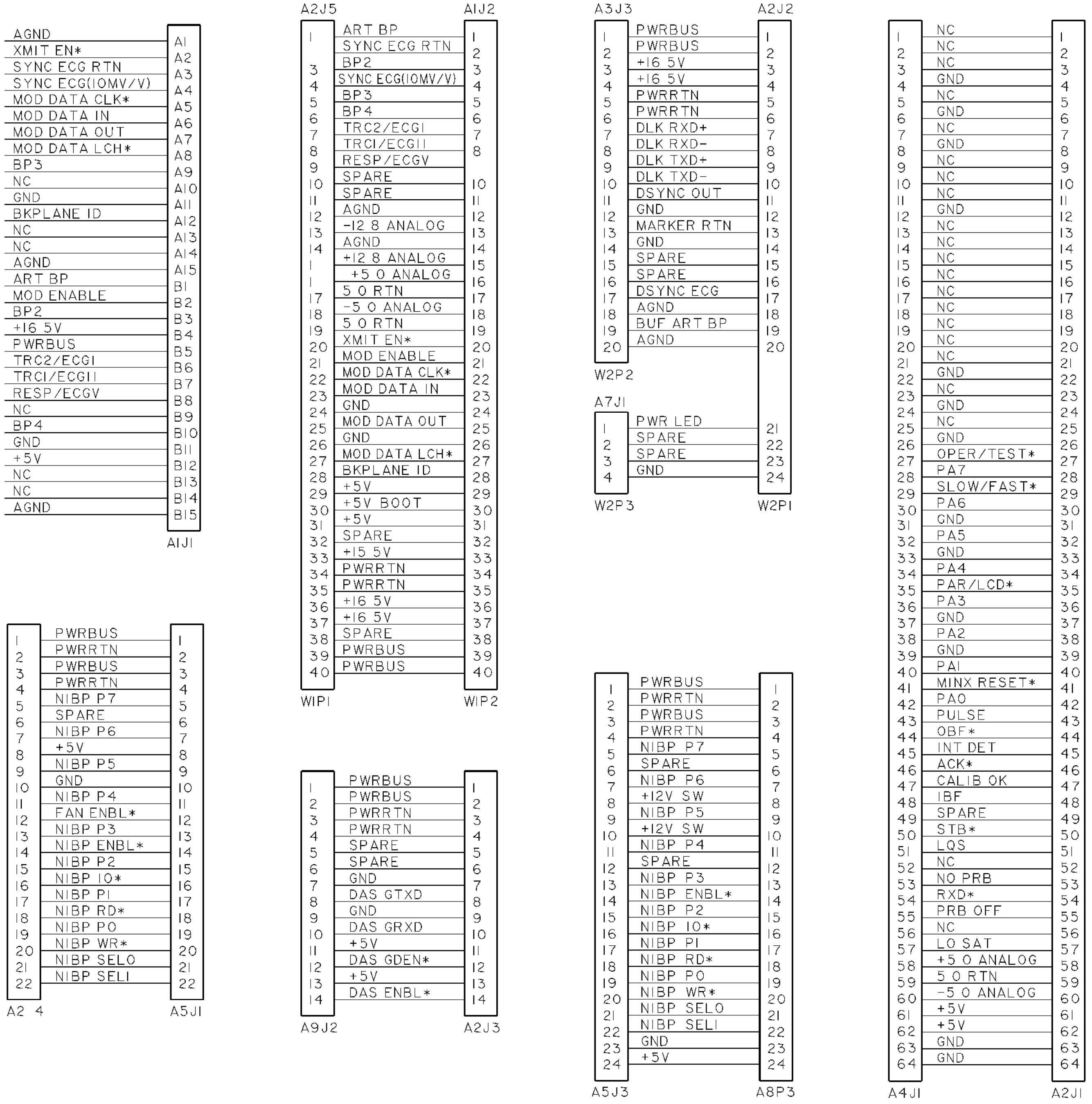
Schematic Diagram PN 410496-001D

1 of 2


L1 VALVE
L2 VALVE
W4
W5
W4P2
A8J2
W5P4
A8J4
A9 DAS ASSY
A9J2
A5 FAN PCB
A5J3
A8P3
A5J1
A8 NIBP PCB
A8J3
W6P1
W6
B1 PUMP
A2J3
A2J4
A3J1
A3 CKT BRD NON-ISO INPUT
A3J2
A3J3
W2P2
W2
W2P1
A2J2
A2 MAIN PROCESSOR PCB
A2J5
W1P1
W1
W1P2
A1J2
A1 POWER/IO PCB
A1J1
A2J1
A4J1
A7 LED LABEL PCB
A7J1
W2P3
A4 SA02 CKT BRD
A4J2
A6J1
A6 INTERCONNECT BRD
A6J2
W3P2
P1
W3


A8J2
1
2
WHT
WHT
+
−
W4P2
L1
A8J4
1
2
WHT
WHT
+
−
W5P4
L2
A8J3
1
2
RED
BLK
+
−
W6P1
B1
1 2 3 4 5 6 7 8 9 10
DETECTOR ANODE
DETECTOR RTN
ID RESISTOR COM
LED ANODES 20 & 30 BIN PROBES
ID RESISTOR #2
ID RESISTOR #1
LED ANODES 300 BIN PROBES
RED.CATHODE
IR CATHODE
NOT USED
1 2 3 4 5 6 7 8 9 10
A6J1
A4J2
A6J2
8 9 7 4 3 5 6 2 1
DETECTOR ANODE
DETECTOR RTN
ID RESISTOR COM
LED ANODES 20 & 30 BIN PROBES
ID RESISTOR #2
ID RESISTOR #1
LED ANODES 300 BIN PROBES
RED CATHODE
IR CATHODE
NOT USED
1 2 3 4 5 6 7 8 9 10
W3P1
W3P2
DLK TXD+
DLK TXD−
DLK RXD+
DLK RXD−
PWRRTN
SENSE OUT
+16 5V
PWRBUS
SHIELD
1 2 3 4 5 6 7 8
A3J1
DEFIB SYNC ECG
GND
MARKER OUT
MARKER IN
AGND
ARTERIAL BP
SHIELD
1 2 3 4 5 6
A3J2

2 of 2



	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD DATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBUS	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J5 W1P1		A1J2 W1P2
1	ART BP	1
	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
1	+12 8 ANALOG	15
1	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40

A3J3 W2P2		A2J2 W2P1
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20

A7J1 W2P3		W2P1
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24

A2 4		A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A9J2		A2J3
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A5J3		A8P3
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+12V SW	8
9	NIBP P5	9
10	+12V SW	10
11	NIBP P4	11
12	SPARE	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
23	GND	23
24	+5V	24

A4J1		A2J1
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64

Parts List PN 410496-001D

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3		Shield, Top	401679-001	1
4		Shield, Bottom	401679-002	1
5		400 Acquisition Module, 5-Lead	410495-001	1
6		Front Bezel, Lower	401105-004	1
7	A5	Fan PCB	403549-002	1
8		Trim, Rubber, Front Bezel	404620-001	1
9		Mounting Strap, Trim	404621-001	1
10	A1, W1	Power Supply PCB	401309-002	1
11		Label, Isolated Connector Function, Tram 400A, English	410540-001	1
12	A2	Module Processor PCB	800210-001	1
13		Circuit Board/Bezel Mount	404762-001	1
14		Shield, Pulse Oximetry PCB	401680-001	1
15		Plate, Chassis Ground, Bottom/Front	402317-001	1
16	A4	Pulse Oximetry PCB	401189-001	1
17		Plate, Chassis Ground, Rear	404680-002	1
19		Spring, Compression	402315-001	2
20		Screw, Power Supply PCB Mounting, SST, 4-40	402214-001	4
21		Label, Model/Serial Number	404525-006	1
22		Power Indicator PCB	403170-008	1
23		Spring, Chassis Ground, Rear	403741-001	AR
24		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
25		Nut, Hex, 4-40	4521-304	2
26		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	19
27		Screw, BDGH, Phillips, 4-40 x 1-3/8	45074-438	2
28		Spacer, Male/Female, 4-40 x 0.875	4656-414	2
29		Screw, 4-40 x 7/8	404069-001	2
30	A3, W2	Non-Isolated Input PCB	401315-002	1
31		Carton, Shipping	404211-003	1
32		Foam Insert	404211-004	2
33		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
34		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
35	A6	Interconnect PCB	800006-001	1
36		Insulator, Bottom Shield	404188-001	2
38		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
39		Washer, Pulse Oximetry Connector	4550-250	1
40		Screw, FLH, Phillips, SST, 4-40 x 3/8	4505-412	2
41		Tram 100 - 850 A & SL Modules Service Manual	404422-065	–
42		Adhesive, Loctite Prism 411	4851-082	AR

Item	**Reference Designation**	**Parts List**	**Part Number**	**Qty**
43		Screw, PNHD, 4-40 x 0.188	409009-001	1
44	W3	Harness, Pulse Oximetry PCB-to-Connector	700091-004	1
45		Pin, Latch	402806-001	2
46		Spring, Flat, SST	405041-001	2
47		Button, Latch	402106-001	2
48		Latch	401682-001	2
49		Spring, Latch	406019-001	2
50		Pin, Latch	406037-001	2
51		Bracket, Power Supply PCB	406254-001	1
52	B1, W6	Pump Assembly, NBP, w/Harness	408169-002	1
53	V1, V2, W4, W5	NBP Valve Assembly	404459-001	1
54	A8	NBP PCB	800316-001	1
55		Bracket, NBP Mounting	404296-001	1
56		Check Valve, 0.125 ID	404675-001	1
57		Tubing, Silastic	401582-001	AR
58		Filter, 43 Micron	404679-001	1
59		Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness	404749-001	5
60		Tie Wrap	4535-002	1
61		Gasket, Silver-Nickel	407894-001	1
62		Adhesive, Conductive	4851-088	AR
65		Label, Leadwire Warning	414097-001	1
–		Label, LED, English (Determined by Destination)	410540-002	1
66		Label, Top, English (Determined by Destination)	410540-009	1
–		Label, Cover, English (Determined by Destination)	410540-016	1
–		Label, 60 Hertz (Determined by Destination)	410540-018	1
–		Label, 50 Hertz (Determined by Destination)	410540-019	1

Assembly Revisions PN 410496

The baseline revision for this assembly is pn 410496-001D. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 410496-001A

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
44		Pulse Oximetry PCB Harness	700091-001	700091-004	1

PN 410496-001B

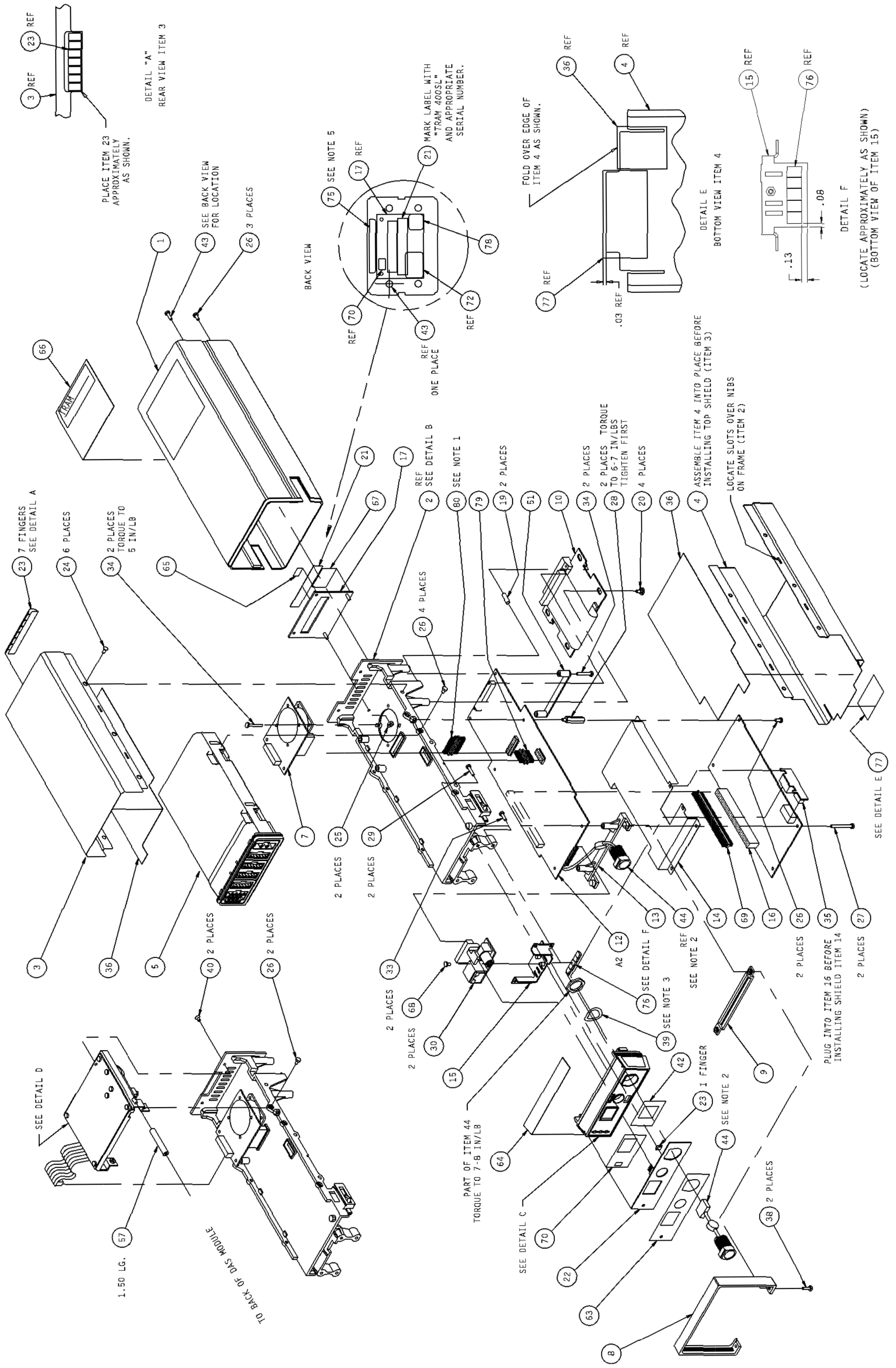
This revision was a documentation change that does not affect this manual.
Refer to pn 410496-001A for changes to the parts list.

PN 410496-001C

This revision was a documentation change that does not affect this manual.
Refer to pn 410496-001A for changes to the parts list.

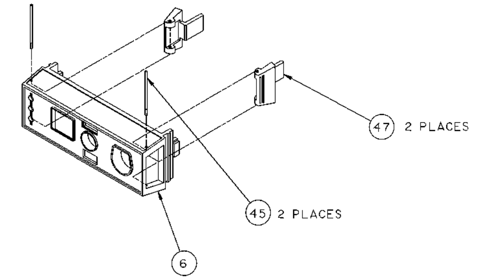
Exploded View PN 411161-001J

1 of 2

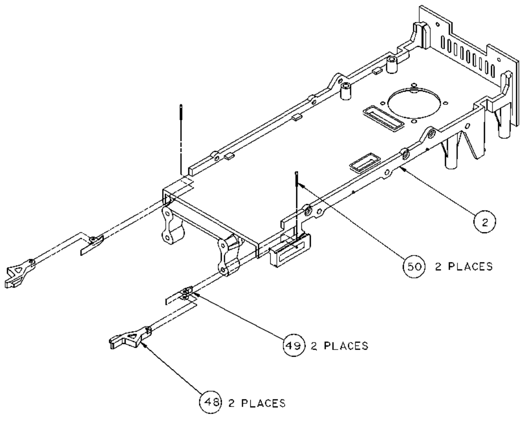

DETAIL "A"
REAR VIEW ITEM 3
PLACE ITEM 23 APPROXIMATELY AS SHOWN.
23 REF
3 REF
1
43 SEE BACK VIEW FOR LOCATION
26 3 PLACES
66
TRAM
BACK VIEW
75 SEE NOTE 5
17 REF
21 MARK LABEL WITH "TRAM 400SL" AND APPROPRIATE SERIAL NUMBER.
78
72 REF
70 REF
43 REF ONE PLACE
FOLD OVER EDGE OF ITEM 4 AS SHOWN.
36 REF
4 REF
77 REF
.03 REF
DETAIL E
BOTTOM VIEW ITEM 4
15 REF
76 REF
.13
.08
DETAIL F
(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 15)
23 7 FINGERS SEE DETAIL A
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
65
21
67
17
2 REF SEE DETAIL B
80 SEE NOTE 1
79
19 2 PLACES
51
10
34 2 PLACES
28 2 PLACES TORQUE TO 6-7 IN/LBS TIGHTEN FIRST
20 4 PLACES
36
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
26 4 PLACES
77 SEE DETAIL E
3
36
5
7
25 2 PLACES
29 2 PLACES
33
12 A2
13 SEE DETAIL F
44 REF SEE NOTE 2
14
69
16
26 2 PLACES
35 PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
27 2 PLACES
40 2 PLACES
26 2 PLACES
68 2 PLACES
30 2 PLACES
76
39 SEE NOTE 3
15
9
42
23 1 FINGER
44 SEE NOTE 2
38 2 PLACES
64 PART OF ITEM 44 TORQUE TO 7-8 IN/LB
70 SEE DETAIL C
22
63
8
SEE DETAIL D
57 1.50 LG.
TO BACK OF DAS MODULE

2 of 2

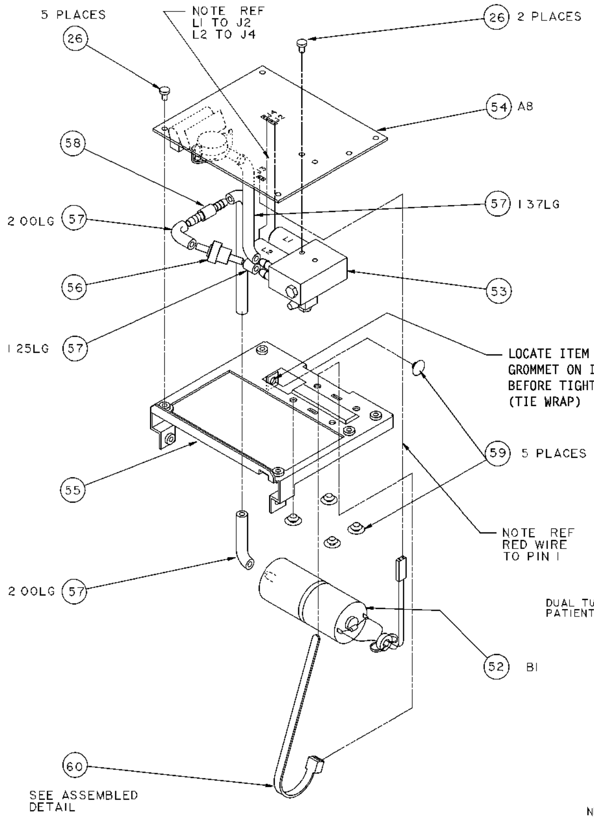
LEAD IDENT	ITEM NO	FROM	TO
W6	52	B1P1	A8J3
W4	53	W4P2	A8J2
W5	53	B1P3	A8J4


47 2 PLACES
45 2 PLACES
6

DETAIL C

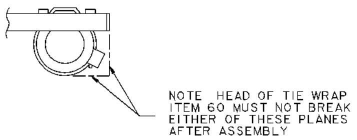

2
50 2 PLACES
49 2 PLACES
48 2 PLACES

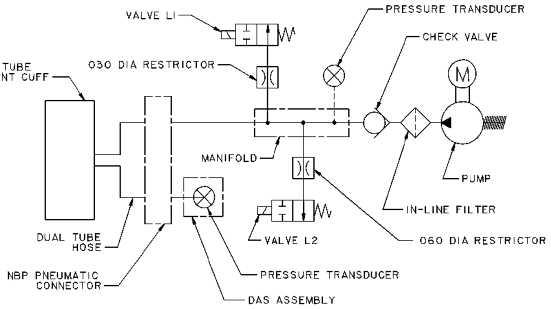
DETAIL B


5 PLACES
26
NOTE REF
L1 TO J2
L2 TO J4
26 2 PLACES
54 A8
58
2 00LG 57
57 1 37LG
56
53
1 25LG 57
LOCATE ITEM 56 9PUMP) AGAINST
GROMMET ON ITEM 59 9BRACKET)
BEFORE TIGHTENING ITEM 64
(TIE WRAP)
55
59 5 PLACES
NOTE REF
RED WIRE
TO PIN 1
2 00LG 57
52 B1
60
SEE ASSEMBLED
DETAIL

DETAIL D

ASSEMBLED DETAIL

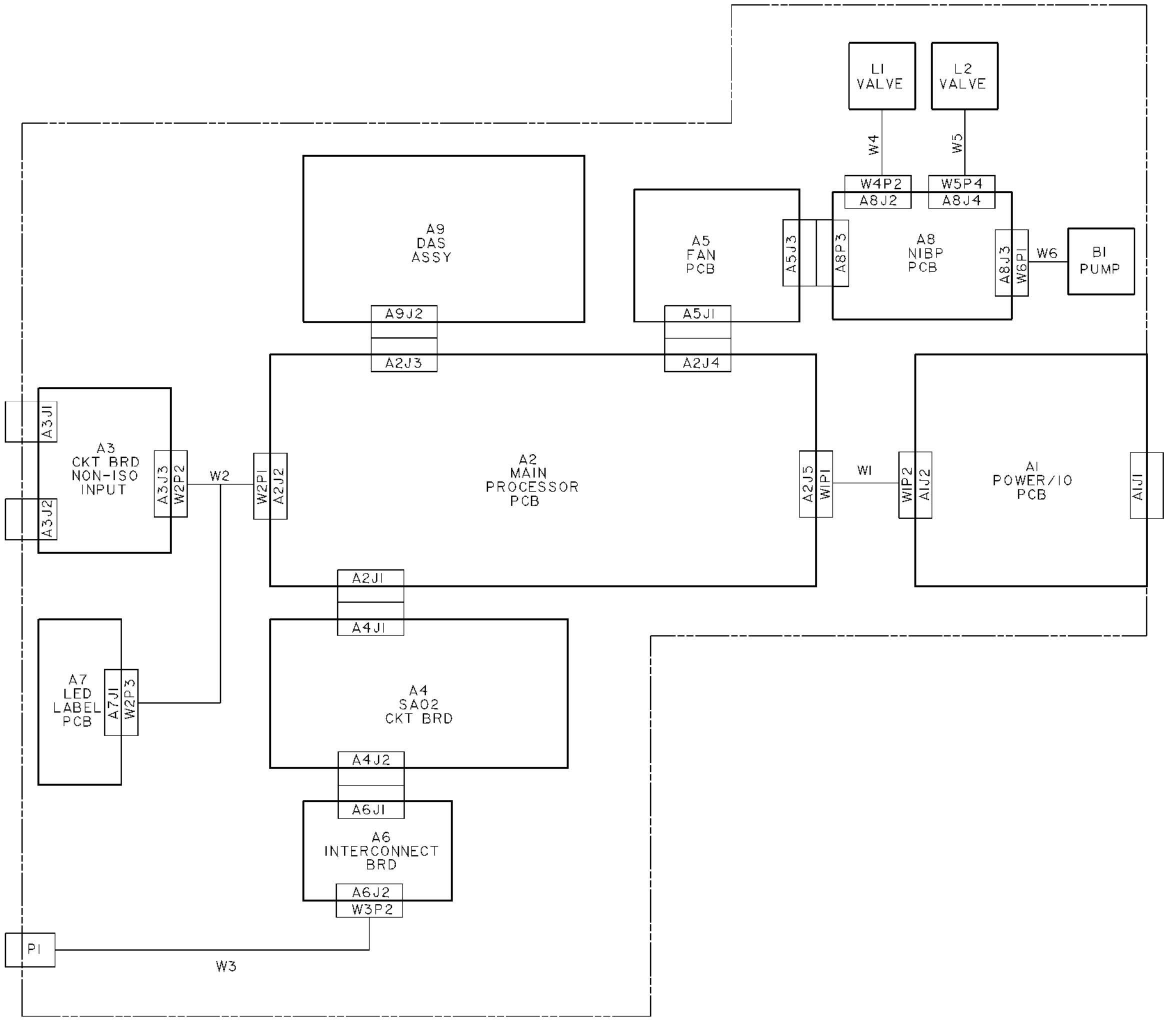

NOTE HEAD OF TIE WRAP
ITEM 60 MUST NOT BREAK
EITHER OF THESE PLANES
AFTER ASSEMBLY

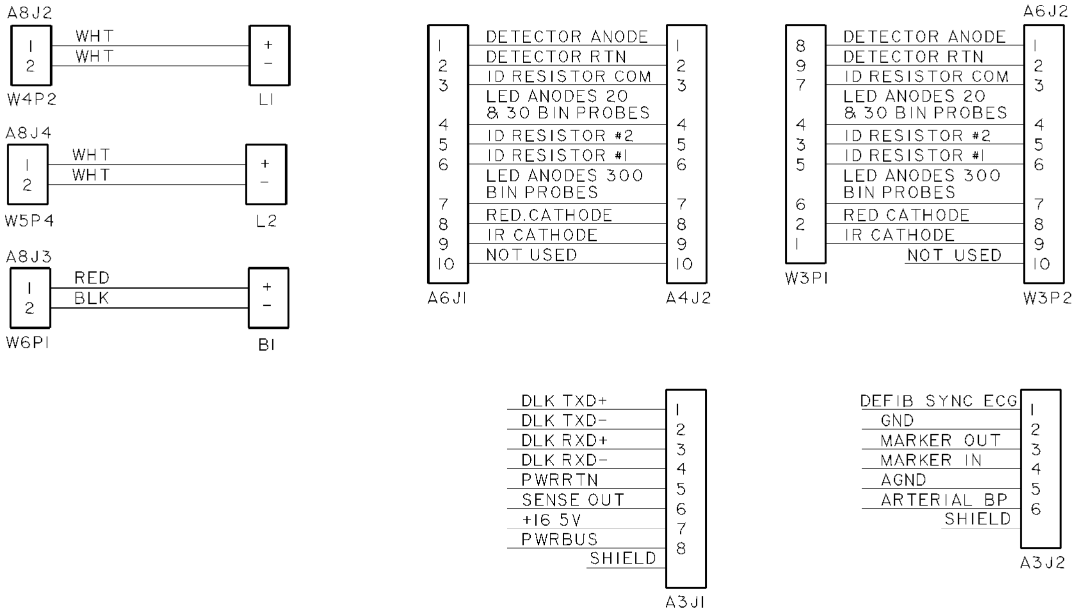

VALVE L1
PRESSURE TRANSDUCER
CHECK VALVE
M
DUAL TUBE
PATIENT CUFF
030 DIA RESTRICTOR
MANIFOLD
PUMP
IN-LINE FILTER
VALVE L2
060 DIA RESTRICTOR
DUAL TUBE
HOSE
PRESSURE TRANSDUCER
NBP PNEUMATIC
CONNECTOR
DAS ASSEMBLY

PNEUMATIC SCHEMATIC

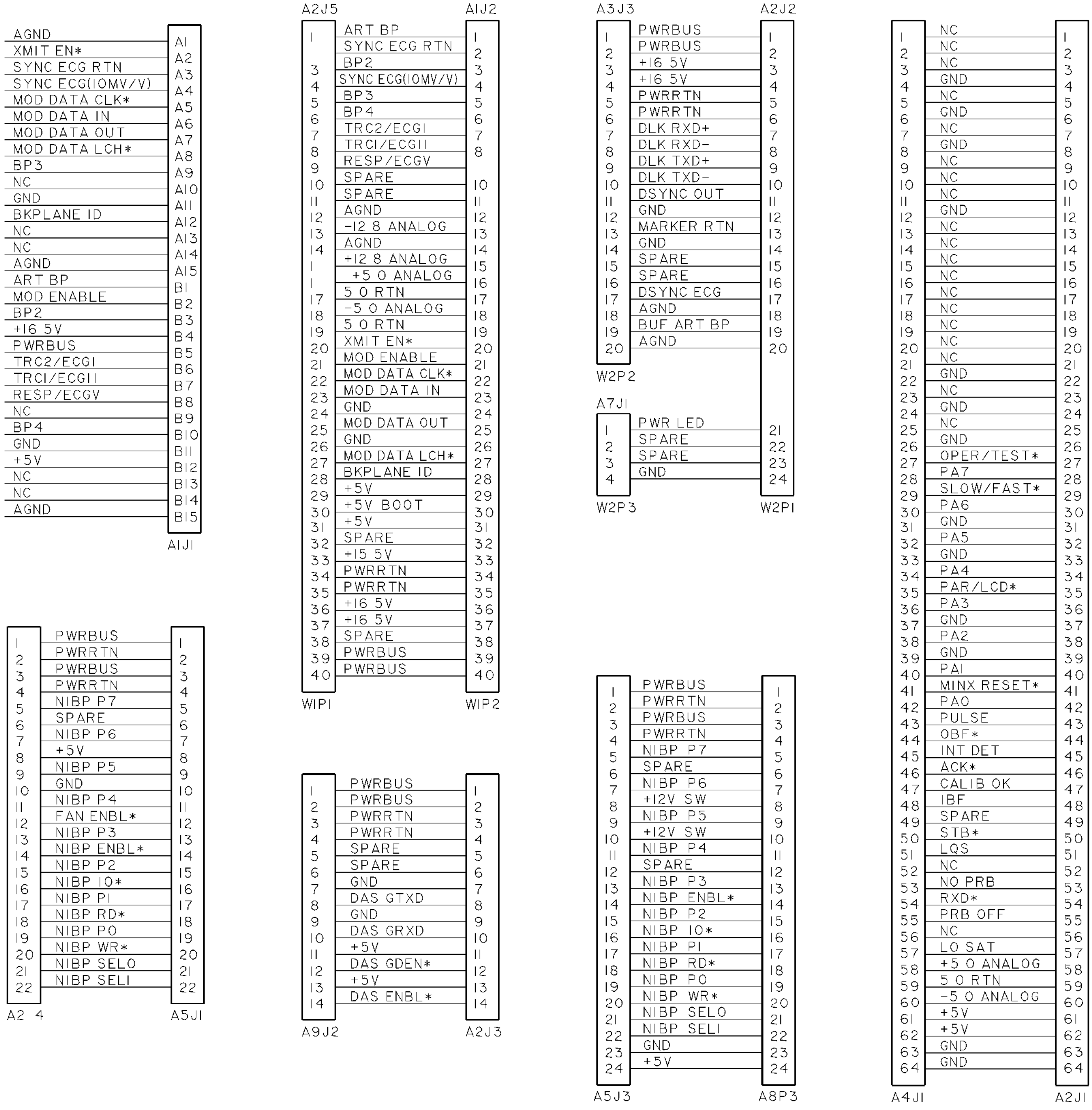
Schematic Diagram PN 411161-001J

1 of 2


L1 VALVE
L2 VALVE
W4
W5
W4P2
A8J2
W5P4
A8J4
A9 DAS ASSY
A9J2
A2J3
A5 FAN PCB
A5J3
A8P3
A5J1
A2J4
A8 NIBP PCB
A8J3
W6P1
W6
B1 PUMP
A3J1
A3 CKT BRD NON-ISO INPUT
A3J3
W2P2
W2
W2P1
A2J2
A3J2
A2 MAIN PROCESSOR PCB
A2J5
W1P1
W1
W1P2
A1J2
A1 POWER/IO PCB
A1J1
A2J1
A4J1
A7 LED LABEL PCB
A7J1
W2P3
A4 SAO2 CKT BRD
A4J2
A6J1
A6 INTERCONNECT BRD
A6J2
W3P2
P1
W3


A8J2
1
2
WHT
WHT
+
−
W4P2
L1
A8J4
1
2
WHT
WHT
+
−
W5P4
L2
A8J3
1
2
RED
BLK
+
−
W6P1
B1
1 DETECTOR ANODE 1
2 DETECTOR RTN 2
3 ID RESISTOR COM 3
4 LED ANODES 20 & 30 BIN PROBES 4
5 ID RESISTOR #2 5
6 ID RESISTOR #1 6
7 LED ANODES 300 BIN PROBES 7
8 RED.CATHODE 8
9 IR CATHODE 9
10 NOT USED 10
A6J1
A4J2
A6J2
8 DETECTOR ANODE 1
9 DETECTOR RTN 2
7 ID RESISTOR COM 3
4 LED ANODES 20 & 30 BIN PROBES 4
3 ID RESISTOR #2 5
5 ID RESISTOR #1 6
6 LED ANODES 300 BIN PROBES 7
2 RED CATHODE 8
1 IR CATHODE 9
NOT USED 10
W3P1
W3P2
DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16 5V 7
PWRBUS 8
SHIELD
A3J1
DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2

2 of 2



Signal	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD DATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBUS	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J5 (W1P1)	Signal	A1J2 (W1P2)
1	ART BP	1
	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
1	+12 8 ANALOG	15
1	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40

A3J3 (W2P2)	Signal	A2J2 (W2P1)
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20

A7J1 (W2P3)	Signal	A2J2 (W2P1)
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24

A2 4	Signal	A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A9J2	Signal	A2J3
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A5J3	Signal	A8P3
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+12V SW	8
9	NIBP P5	9
10	+12V SW	10
11	NIBP P4	11
12	SPARE	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
23	GND	23
24	+5V	24

A4J1	Signal	A2J1
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64

Parts List PN 411161-001J

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3		Shield, Top	401679-001	1
4		Shield, Bottom	401679-002	1
5	A9	400 Acquisition Module, 10-Lead	417121-001	1
6		Front Bezel, Lower	401105-004	1
7	A5	Fan PCB	403549-002	1
8		Trim, Rubber, Front Bezel	404620-001	1
9		Mounting Strap, Trim	404621-001	1
10	A1, W1	Power Supply PCB	401309-002	1
12	A2	Module Processor PCB	800210-005	1
13		Circuit Board/Bezel Mount	404762-001	1
14		Shield, Pulse Oximetry PCB	401680-001	1
15		Plate, Chassis Ground, Bottom/Front	402317-001	1
16	A4	Pulse Oximetry PCB	401189-001	1
17		Plate, Chassis Ground, Rear	404680-002	1
19		Spring, Compression	402315-001	2
20		Screw, Power Supply PCB Mounting, SST, 4-40	402214-001	4
21		Label, Model/Serial Number	404525-006	1
22		Power Indicator	403170-008	1
23		Spring, Chassis Ground, Rear	403741-001	AR
24		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
25		Nut, Hex, 4-40	4521-304	2
26		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	17
27		Screw, BDGH, Phillips, 4-40 x 1-3/8	45074-438	2
28		Spacer, Male/Female, 4-40 x 0.875	4656-414	2
29		Screw, 4-40 x 7/8	404069-001	2
30	A3	Non-Isolated Input PCB	401315-002	1
31		Carton, Shipping	404211-003	1
32		Foam Insert	404211-004	2
33		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
34		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
35	A6	Interconnect PCB	800006-001	1
36		Insulator, Bottom Shield	404188-001	2
38		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
39		Washer, Pulse Oximetry Connector	4550-250	1
40		Screw, FLH, Phillips, SST, 4-40 x 3/8	4505-412	2
41		Tram 100 - 850 A & SL Modules Service Manual	404422-065	–
42		Adhesive, Diecut, Front Right	415098-001	1
43		Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination)	409009-001	1

Item	Reference Designation	Parts List	Part Number	Qty
43		Screw, PHD, 4-40 x 0.188 (Determined by Destination)	45074-406	1
44	W3	Harness Assembly, SpO2 - w/Choke	700091-004	1
45		Pin, Latch	402806-001	2
47		Button, Latch	402106-001	2
48		Latch	401682-001	2
49		Spring, Latch	406019-001	2
50		Pin, Latch	406037-001	2
51		Bracket, Power Supply PCB	406254-001	1
52	B1, W6	Pump Assembly, NBP, w/Harness	408169-002	1
53	V1, V2, W4, W5	NBP Valve Assembly	416153-001	1
54	A8	NBP PCB	800316-002	1
55		Bracket, NBP Mounting	404296-001	1
56		Check Valve, 0.125 ID	404675-001	1
57		Tubing, Silastic	401582-001	AR
58		Filter, 43 Micron	404679-001	1
59		Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness	404749-001	5
60		Tie Wrap	4535-002	1
63		Label, Front, English (Determined by Destination)	411174-002	1
63		Label, Front, German (Determined by Destination)	411174-003	1
63		Label, Front, French (Determined by Destination)	411174-004	1
63		Label, Front, Swedish (Determined by Destination)	411174-005	1
63		Label, Front, Spanish (Determined by Destination)	411174-006	1
63		Label, Front, Italian (Determined by Destination)	411174-007	1
63		Label, Front, Dutch (Determined by Destination)	411174-008	1
64		Label, Top, English (Determined by Destination)	411174-009	1
64		Label, Top, German (Determined by Destination)	411174-010	1
64		Label, Top, French (Determined by Destination)	411174-011	1
64		Label, Top, Swedish (Determined by Destination)	411174-012	1
64		Label, Top, Spanish (Determined by Destination)	411174-013	1
64		Label, Top, Italian (Determined by Destination)	411174-014	1
64		Label, Top, Dutch (Determined by Destination)	411174-015	1
65		Label, 60 Hertz (Determined by Destination)	411091-018	1
65		Label, 50 Hertz (Determined by Destination)	411031-019	1
66		Label, Cover, English (Determined by Destination)	411174-016	1
66		Label, Cover, German (Determined by Destination)	411174-020	1
66		Label, Cover, French (Determined by Destination)	411174-021	1
66		Label, Cover, Swedish (Determined by Destination)	411174-022	1
66		Label, Cover, Spanish (Determined by Destination)	411174-023	1
66		Label, Cover, French (Determined by Destination)	4111734-024	1
66		Label, Cover, International (Determined by Destination)	411174-025	1
67		Label, TUV	408103-002	1

Item	Reference Designation	Parts List	Part Number	Qty
67		Label, UL Listed	408230-002	1
68		Screw, PNH, Phillips, SST, 4-40 x 3/16	4502-406	2
69	P1	Connector, Header, 64-Pin, w/Ferrites	409203-001	1
70		Adhesive, Diecut, Front Left	415098-002	1
76		Spring, Chassis Ground, Small	414610-001	AR
77		Adhesive, Mylar	415316-001	1
78		Label, CE Mark	408230-008	1
79		PC Post, 2 x 7	412062-004	1
80		PC Post, 2 x 11	412062-005	1

Assembly Revisions PN 411161

The baseline revision for this assembly is pn 411161-001J. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 411161-001A

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 400 Module, 10-Lead	411167-001	417121-001	1
11		Label Set, Tram 400SL	411174-001	Not Used	1
12		Module Processor PCB	800210-002	800210-005	1
42		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
46		Bezel Kit, Front	407721-004	Not Used	1
53	V1, V2, W4, W5	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1
57		NBP Tram Valve Assembly	404459-001	413021-001	1
68		Screw, Phillips, STT, 4-40 x 3/16	Not Used	4502-406	2
69		Connector, Header 64-pin w/Ferrites	Not Used	409203-001	1
70		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411161-001B

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 400 Module, 10-Lead	411167-001	417121-001	1
11		Label Set, Tram 400SL	411174-001	Not Used	1
12		Module Processor PCB	800210-002	800210-005	1
42		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
46		Bezel Kit, Front	407721-004	Not Used	1
53	V1, V2, W4, W5	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1
68		Screw, Phillips, STT, 4-40 x 3/16	Not Used	4502-406	2
69		Connector, Header 64-pin w/Ferrites	Not Used	409203-001	1
70		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411161-001C

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 400 Module, 10-Lead	411167-001	417121-001	1
12		Module Processor PCB	800210-002	800210-005	1
42		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
53	V1, V2, W4, W5	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1
70		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411161-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 411161-001C for changes to the parts list.

PN 411161-001E

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 400 Module, 10-Lead	411167-001	417121-001	1
12		Module Processor PCB	800210-002	800210-005	1
53	V1, V2, W4, W5	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411161-001F

This revision was a documentation change that does not affect this manual.
Refer to pn 411161-001E for changes to the parts list.

PN 411161-001G

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 400 Module, 10-Lead	411167-001	417121-001	1
53	V1, V2, W4, W5	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1

PN 411161-001H

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 400 Module, 10-Lead	411167-001	417121-001	1
54	A8	NBP PCB	800316-001	800316-002	1

For your notes

11 TRAM 450SL MODULE

PN 412654

General **11-2**
Circuit Boards.. 11-2

Exploded View PN 412654-001H **11-3**

Schematic Diagram PN 412654-001H **11-5**

Parts List PN 412654-001H **11-7**

Assembly Revisions PN 412654.. **11-10**

General

Circuit Boards

Details about the circuit boards contained in the Tram 450SL are discussed in later chapters arranged by part number.

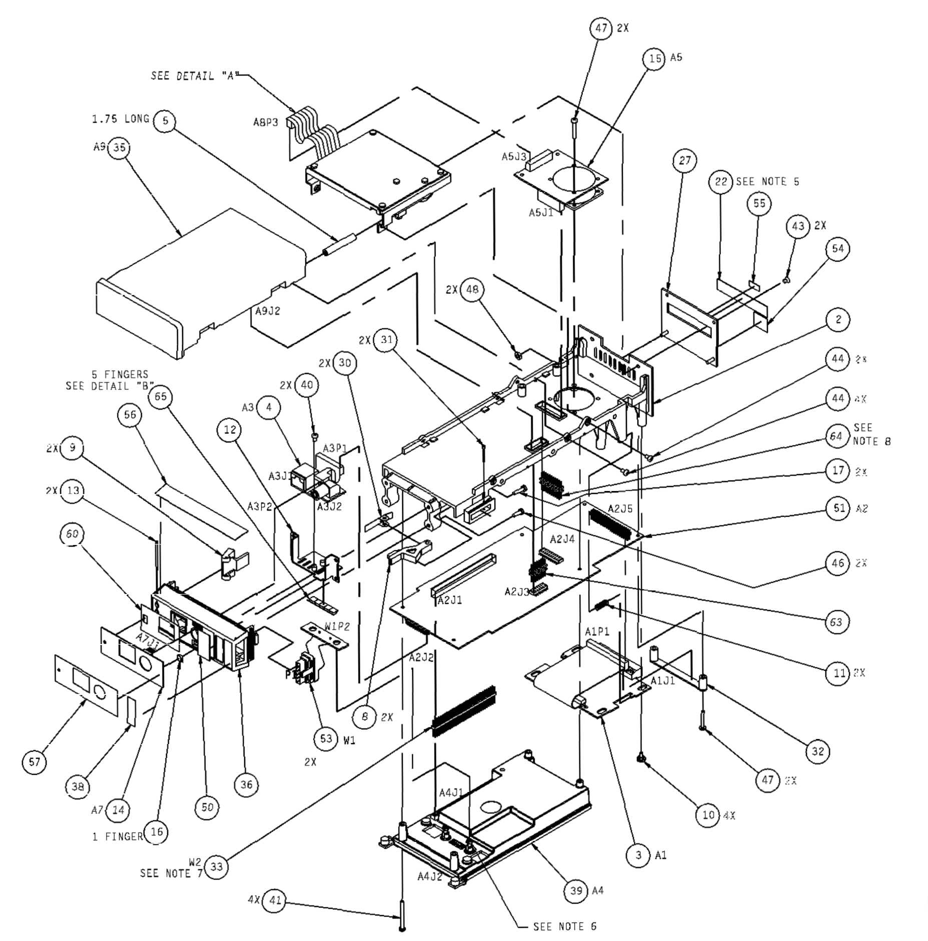
Table 8-1. Circuit Board Overview

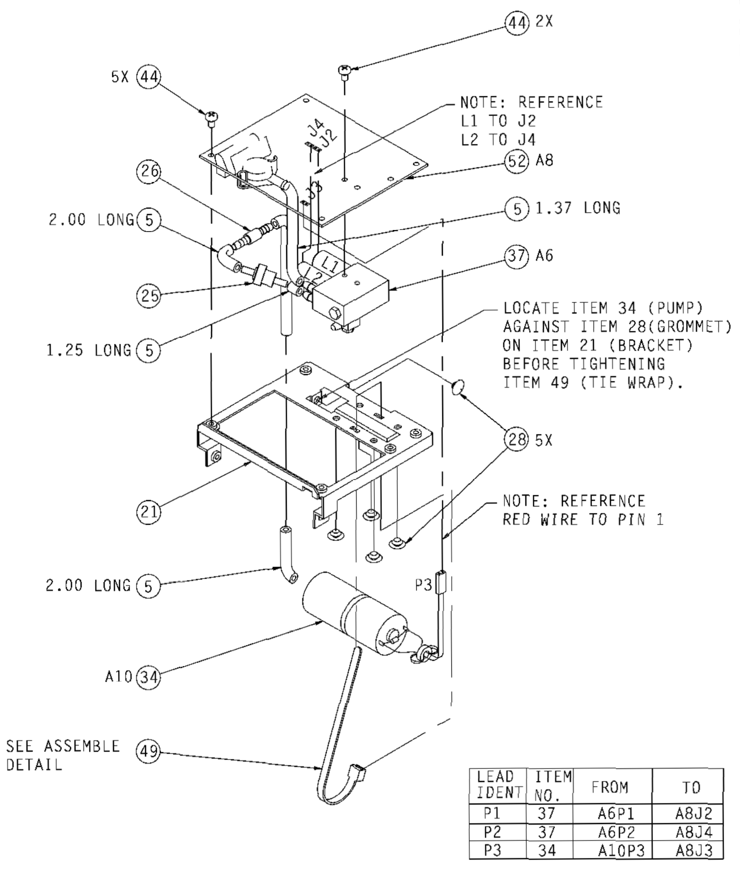
Module Type	Upper Level	Leadwire Configuration	DAS Module	Acquisition Processor PCB	Module Processor PCB
Tram 450SL	412654-001A-G	10-Leadwire	411167-001	800330-010	800210-005
Tram 450SL	412654-001H	10-Leadwire	417121-001 (Replaces 411167-001)	801040-001	800210-005

Exploded View

PN 412654-001H

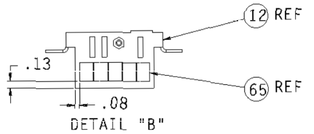
1 of 2


47 2X
15 A5
SEE DETAIL "A"
A8P3
1.75 LONG 5
A9 35
A5J3
A5J1
27
22 SEE NOTE 5
55
43 2X
54
2
44 2X
44 4X
64 SEE NOTE 8
17 2X
51 A2
46 2X
63
11 2X
32
47 2X
10 4X
3 A1
39 A4
SEE NOTE 6
A9J2
2X 48
2X 31
2X 30
2X 40
A3 4
12
A3P1
A3J1
A3J2
A3P2
5 FINGERS SEE DETAIL "B"
65
56
2X 9
2X 13
60
57
38
A7 14
A7J1
1 FINGER 16
50
36
W1P2
53 W1
2X
8 2X
A2J5
A2J4
A2J3
A2J1
A2J2
A1P1
A1J1
A4J1
A4J2
W2 SEE NOTE 7 33
4X 41


44 2X
5X 44
NOTE: REFERENCE
L1 TO J2
L2 TO J4
J4
J2
L1
52 A8
26
5 1.37 LONG
2.00 LONG 5
37 A6
25
LOCATE ITEM 34 (PUMP) AGAINST ITEM 28(GROMMET) ON ITEM 21 (BRACKET) BEFORE TIGHTENING ITEM 49 (TIE WRAP).
1.25 LONG 5
28 5X
21
NOTE: REFERENCE RED WIRE TO PIN 1
2.00 LONG 5
P3
A10 34
SEE ASSEMBLE DETAIL 49

LEAD IDENT	ITEM NO.	FROM	TO
P1	37	A6P1	A8J2
P2	37	A6P2	A8J4
P3	34	A10P3	A8J3

DETAIL "A"

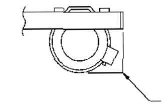

12 REF
65 REF
.13
.08

DETAIL "B"

(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 12)

NOTES:

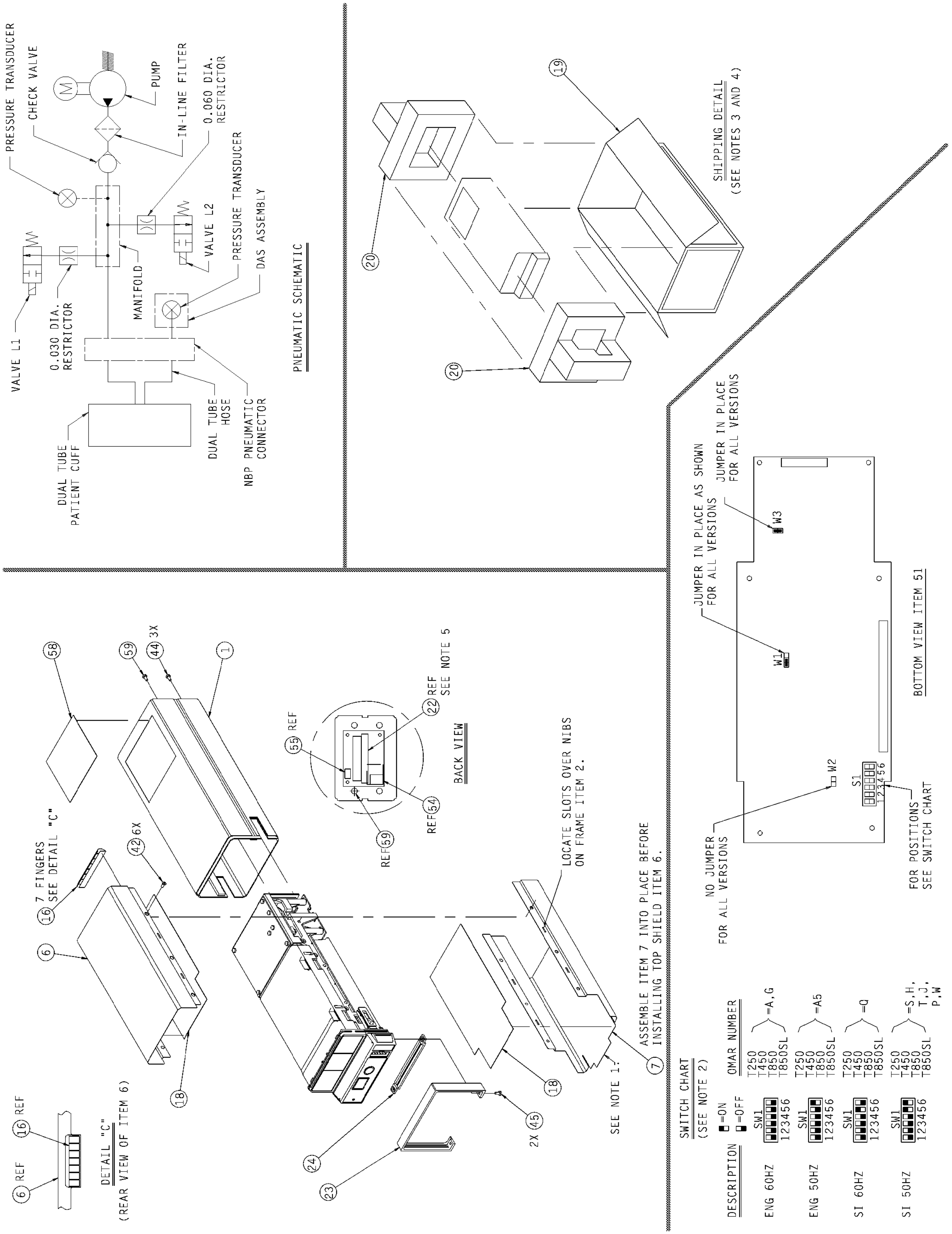
1. *WHEN SHIELD (ITEM 7) IS INSTALLED, THE TAB SHOULD TUCK INTO THE* FRONT BEZEL (ITEM 36) AND BE IN CONTACT WITH THE SHIELDING FINGERS (ITEM 16) ON THE BOTTOM OF THE BRACKET (ITEM 12).
2. SWITCH SETTINGS MUST BE MADE FOR EACH CONFIGURATION (SEE SWITCH CHART SHEET 2).
3. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
4. *LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND* SHIPPED SEPARATELY.
5. MARK LABEL WITH MODEL NUMBER, SERIAL NUMBER, AND BAR CODE.
6. INSERT TWO HOLES OF FLEX PCB (ITEM 53) ONTO 1/4-TURN STANDOFF (ITEM 39) UNTIL CONNECTOR ON PCB FLEX BOTTOMS OUT. THEN LOCK THE STANDOFFS BY TURNING THE HEX SCREW OF THE STANDOFF 1/4-TURN CLOCKWISE.
7. INSERT THE SHORT LEADS OF CONNECTOR (ITEM 33) INTO PCB TRAM CPU (ITEM 51).
8. INSERT LONGER PIN SIDE INTO ITEM 51. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 51 WHEN ASSEMBLED.



ASSEMBLED DETAIL

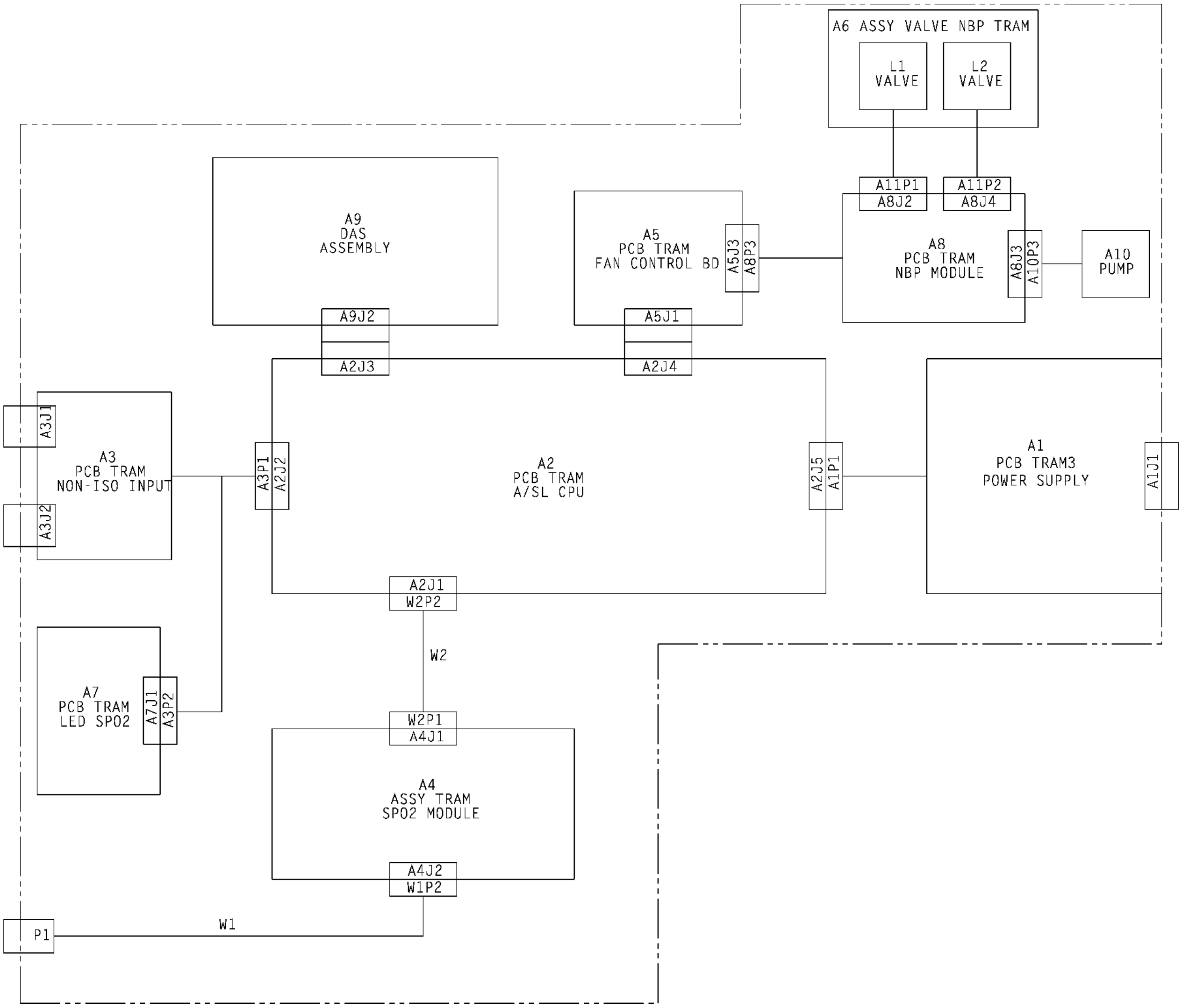
NOTE: HEAD OF TIE WRAP ITEM 49 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY.

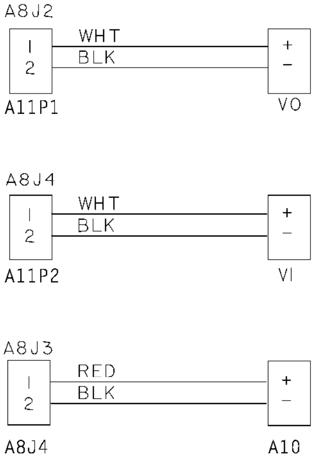
2 of 2

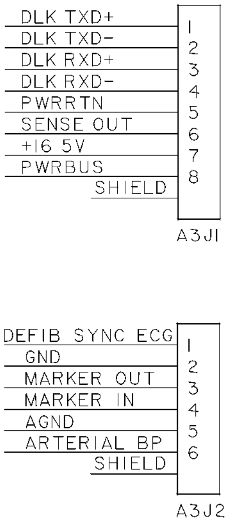

PNEUMATIC SCHEMATIC
PRESSURE TRANSDUCER
CHECK VALVE
PUMP
M
IN-LINE FILTER
0.060 DIA. RESTRICTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY
VALVE L2
MANIFOLD
VALVE L1
0.030 DIA. RESTRICTOR
DUAL TUBE PATIENT CUFF
DUAL TUBE HOSE
NBP PNEUMATIC CONNECTOR
SHIPPING DETAIL
(SEE NOTES 3 AND 4)
19
20
20
58
59
44 3X
1
REF SEE NOTE 5
22
55 REF
BACK VIEW
REF 54
REF 59
7 FINGERS SEE DETAIL "C"
16
42 6X
6
18
LOCATE SLOTS OVER NIBS ON FRAME ITEM 2.
ASSEMBLE ITEM 7 INTO PLACE BEFORE INSTALLING TOP SHIELD ITEM 6.
7
18
SEE NOTE 1.
2X 45
24
23
6 REF
16 REF
DETAIL "C"
(REAR VIEW OF ITEM 6)
JUMPER IN PLACE AS SHOWN FOR ALL VERSIONS
JUMPER IN PLACE FOR ALL VERSIONS
W3
W1
NO JUMPER FOR ALL VERSIONS
W2
S1
123456
FOR POSITIONS SEE SWITCH CHART
BOTTOM VIEW ITEM 51
SWITCH CHART
(SEE NOTE 2)
■ =ON
■ =OFF
DESCRIPTION
OMAR NUMBER
ENG 60HZ
SW1
123456
T250 T450 T850 T850SL =A,G
ENG 50HZ
SW1
123456
T250 T450 T850 T850SL =A5
SI 60HZ
SW1
123456
T250 T450 T850 T850SL =Q
SI 50HZ
SW1
123456
T250 T450 T850 T850SL =S,H, T,J, P,W

Schematic Diagram PN 412654-001H

1 of 2

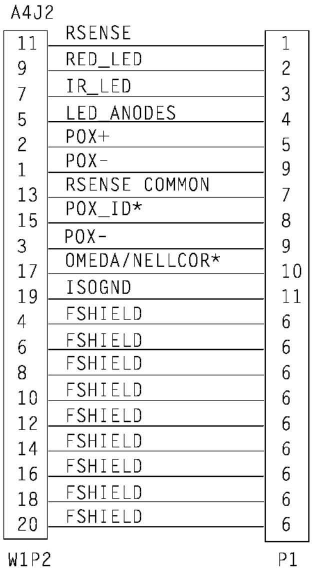

A6 ASSY VALVE NBP TRAM
L1 VALVE
L2 VALVE
A11P1
A8J2
A11P2
A8J4
A9 DAS ASSEMBLY
A9J2
A5 PCB TRAM FAN CONTROL BD
A5J3
A8P3
A5J1
A8 PCB TRAM NBP MODULE
A8J3
A10P3
A10 PUMP
A2J3
A2J4
A3J1
A3J2
A3 PCB TRAM NON-ISO INPUT
A3P1
A2J2
A2 PCB TRAM A/SL CPU
A2J5
A1P1
A1 PCB TRAM3 POWER SUPPLY
A1J1
A2J1
W2P2
W2
W2P1
A4J1
A7 PCB TRAM LED SPO2
A7J1
A3P2
A4 ASSY TRAM SPO2 MODULE
A4J2
W1P2
P1
W1


A8J2
1
2
WHT
BLK
+
−
A11P1
VO
A8J4
1
2
WHT
BLK
+
−
A11P2
VI
A8J3
1
2
RED
BLK
+
−
A8J4
A10



Signal	A3J1
DLK TXD+	1
DLK TXD-	2
DLK RXD+	3
DLK RXD-	4
PWRRTN	5
SENSE OUT	6
+16 5V	7
PWRBUS	8
SHIELD	

Signal	A3J2
DEFIB SYNC ECG	1
GND	2
MARKER OUT	3
MARKER IN	4
AGND	5
ARTERIAL BP	6
SHIELD	


A4J2
W1P2
P1

W1P2		P1
11	RSENSE	1
9	RED_LED	2
7	IR_LED	3
5	LED ANODES	4
2	POX+	5
1	POX-	9
13	RSENSE COMMON	7
15	POX_ID*	8
3	POX-	9
17	OMEDA/NELLCOR*	10
19	ISOGND	11
4	FSHIELD	6
6	FSHIELD	6
8	FSHIELD	6
10	FSHIELD	6
12	FSHIELD	6
14	FSHIELD	6
16	FSHIELD	6
18	FSHIELD	6
20	FSHIELD	6

2 of 2

	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD ATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBU	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J4		A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A2J5 A1P1		A1J2
1	ART BP	1
2	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	9
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
15	+12 8 ANALOG	15
16	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40

A9J2		A2J3
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A3J3 W2P2		A2J2 W2P1
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20

A7J1 A3P1		A2J2 W2P1
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24

A5J3		A8P3
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+12V SW	8
9	NIBP P5	9
10	+12V SW	10
11	NIBP P4	11
12	SPARE	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
23	GND	23
24	+5V	24

A4J1 W2P1		A2J1 W2P2
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64

Parts List PN 412654-001H

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3	A1	Power Supply PCB	401309-002	1
4	A3	Non-Isolated Input PCB	401315-002	1
5		Tubing, Silastic	401582-001	AR
6		Shield, Top	401679-001	1
7		Shield, Bottom	401679-002	1
8		Latch	401682-001	2
9		Button, Latch	402106-001	2
10		Screw, Shoulder	402214-001	4
11		Spring, Compression	402315-001	2
12		Plate, Chassis Ground, Bottom/Front	402317-001	1
13		Pin, Latch	402806-001	2
14	A7	Power Indicator PCB	403170-011	1
15	A5	Fan PCB	403549-002	1
16		Spring, Chassis Ground, Rear	403741-001	AR
17		Screw, BDGH, Phillips, 4-40 x 7/8	404069-001	2
18		Insulator, Bottom Shield	404188-001	2
19		Carton, Shipping	404211-003	1
20		Foam, Insert	404211-004	1
21		Bracket, NBP Mounting	404296-001	1
22		Label, Blank	404525-006	1
23		Trim, Rubber, Front Bezel	404620-001	1
24		Mounting Strap, Trim	404621-001	1
25		Check Valve, 0.125 ID	404675-001	1
26		Filter, 43 Micron	404679-001	1
27		Plate, Chassis Ground, Rear	404680-002	1
28		Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness	404749-001	5
30		Spring, Latch	406019-001	2
31		Pin, Latch	406037-001	2
32		Bracket, Power Supply PCB	406254-001	1
33	W2	Connector, Header, Dual, 64-Pin	407452-002	1
34	A10	Pump Assembly, NBP, w/Harness	408169-002	1
35	A9	400 Acquisition Module, 10-Lead	417121-001	1
36		Front Bezel, Tram	412659-001	1
37	A6	NBP Valve Assembly	416153-002	1
38		Label, Pulse Oximetry, Nellcor	413831-002	1
39	A4	Pulse Oximetry Assembly (Including Pulse Oximetry PCB, PN 800674-00X)	414409-001	1
40		Screw, BDGH, Phillips, 4-40 x 3/16	4502-406	2
41		Screw, BDGH, Phillips, 4-40 x 1-1/4	4502-440	4

Item	Reference Designation	Parts List	Part Number	Qty
42		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
43		Screw, FLH, Phillips, SST, 4-40 x 3/8	4505-412	2
44		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	16
45		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
46		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
47		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
48		Nut, Hex, 4-40	4521-304	2
49		Tie Wrap	4535-002	1
50		Adhesive, Diecut, Front Right	415098-003	1
51	A2	Module Processor PCB	800210-005	1
52	A8	NPB PCB	800316-002	1
53	W1	Harness, Pulse Oximetry PCB-to-Connector	800892-001	1
54		Label, UL (Determined by Destination)	408230-002	1
55		Label, 60 Hertz	411091-018	1
55		Label, 50 Hertz	411091-019	1
56		Label, Top, English (Determined by Destination)	411174-009	1
56		Label, Top, German (Determined by Destination)	411174-010	1
56		Label, Top, French (Determined by Destination)	411174-011	1
56		Label, Top, Swedish (Determined by Destination)	411174-012	1
56		Label, Top, Spanish (Determined by Destination)	411174-013	1
56		Label, Top, Italian (Determined by Destination)	411174-014	1
56		Label, Top, Dutch (Determined by Destination)	411174-015	1
57		Label, Front, 450SL, English (Determined by Destination)	413837-001	1
57		Label, Front, 450SL, German (Determined by Destination)	413837-002	1
57		Label, Front, 450SL, French (Determined by Destination)	413837-003	1
57		Label, Front, 450SL, Swedish (Determined by Destination)	413837-004	1
57		Label, Front, 450SL, Spanish (Determined by Destination)	413837-005	1
57		Label, Front, 450SL, Italian (Determined by Destination)	413837-006	1
57		Label, Front, 450SL, Dutch (Determined by Destination)	413837-007	1
58		Label, Cover, English (Determined by Destination)	414047-001	1
58		Label, Cover, German (Determined by Destination)	414047-002	1
58		Label, Cover, French (Determined by Destination)	414047-003	1
58		Label, Cover, Swedish (Determined by Destination)	414047-004	1
58		Label, Cover, Spanish (Determined by Destination)	414047-005	1
58		Label, Cover, Italian (Determined by Destination)	414047-006	1
58		Label, Cover, International (Determined by Destination)	414047-007	1
59		Spring, Chassis Ground, Small	414610-001	AR

Item	Reference Designation	Parts List	Part Number	Qty
59		Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination)	409009-001	1
59		Screw, PHD, 4-40 x 0.188 (Determined by Destination)	45074-406	1
60		Adhesive, Diecut, Front Left	415098-002	1
61		Tram 100 - 850 A and SL Module Service Manual	404422-065	1
62		Label, CE Mark	408230-008	1
63		PC Post, 2 x 7	412062-004	1
64		PC Post, 2 x 11	412062-005	1

Assembly Revisions PN 412654

The baseline revision for this assembly is pn 412654-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 412654-001A

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 400 Module, 10-Lead	411167-001	417121-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
50		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
51		Module Processor PCB	800210-002	800210-005	1
52	A8	NBP PCB	800316-001	800316-002	1
59		Spring, Chassis Ground, Small	Not Used	414610-001	AR
60		Adhesive, Diecut, Front Left	Not Used	415098-002	1
62		Label, CE Mark	Not Used	408230-008	1
63		PC Post, 2 x 7	Not Used	412062-004	1
64		PC Post, 2 x 11	Not Used	412062-005	1

PN 412654-001B

This revision was a documentation change that does not affect this manual.
Refer to pn 412654-001A for changes to the parts list.

PN 412654-001C

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 400 Module, 10-Lead	411167-001	417121-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
51		Module Processor PCB	800210-002	800210-005	1
52	A8	NBP PCB	800316-001	800316-002	1
62		Label, CE Mark	Not Used	408230-008	1
63		PC Post, 2 x 7	Not Used	412062-004	1
64		PC Post, 2 x 11	Not Used	412062-005	1

PN 412654-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 412654-001C for changes to the parts list.

PN 412654-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 412654-001C for changes to the parts list.

PN 412654-001F

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 400 Module, 10-Lead	411167-001	417121-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
52	A8	NBP PCB	800316-001	800316-002	1

PN 412651-001G

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 400 Module, 10-Lead	411167-001	417121-001	1
52	A8	NBP PCB	800316-001	800316-002	1

For your notes

12 TRAM 500A MODULE
PN 408003

General **12-2**
Circuit Boards.. 12-2
Tram 500A Configurations 12-2

Exploded View PN 408003C **12-3**

Schematic Diagram PN 408003C **12-5**

Parts List PN 408003C **12-7**

Assembly Revisions PN 408003 .... **12-9**

General

Circuit Boards

Details about the circuit boards contained in the Tram 500A are discussed in later chapters arranged by part number.

Table 12-1. Circuit Board Overview

Module Type	Upper Level	Leadwire Configuration	DAS Module	Acquisition Processor PCB	Module Processor PCB
Tram 500A	408003-0XX	5-Leadwire	408133-001	800330-002	800210-005

Tram 500A Configurations

At the time of this writing, we make 16 configurations of the Tram 500A module. The differences between configurations are in the power frequency, the type of labelling, and the units of measure used. The table below lists the available configurations.

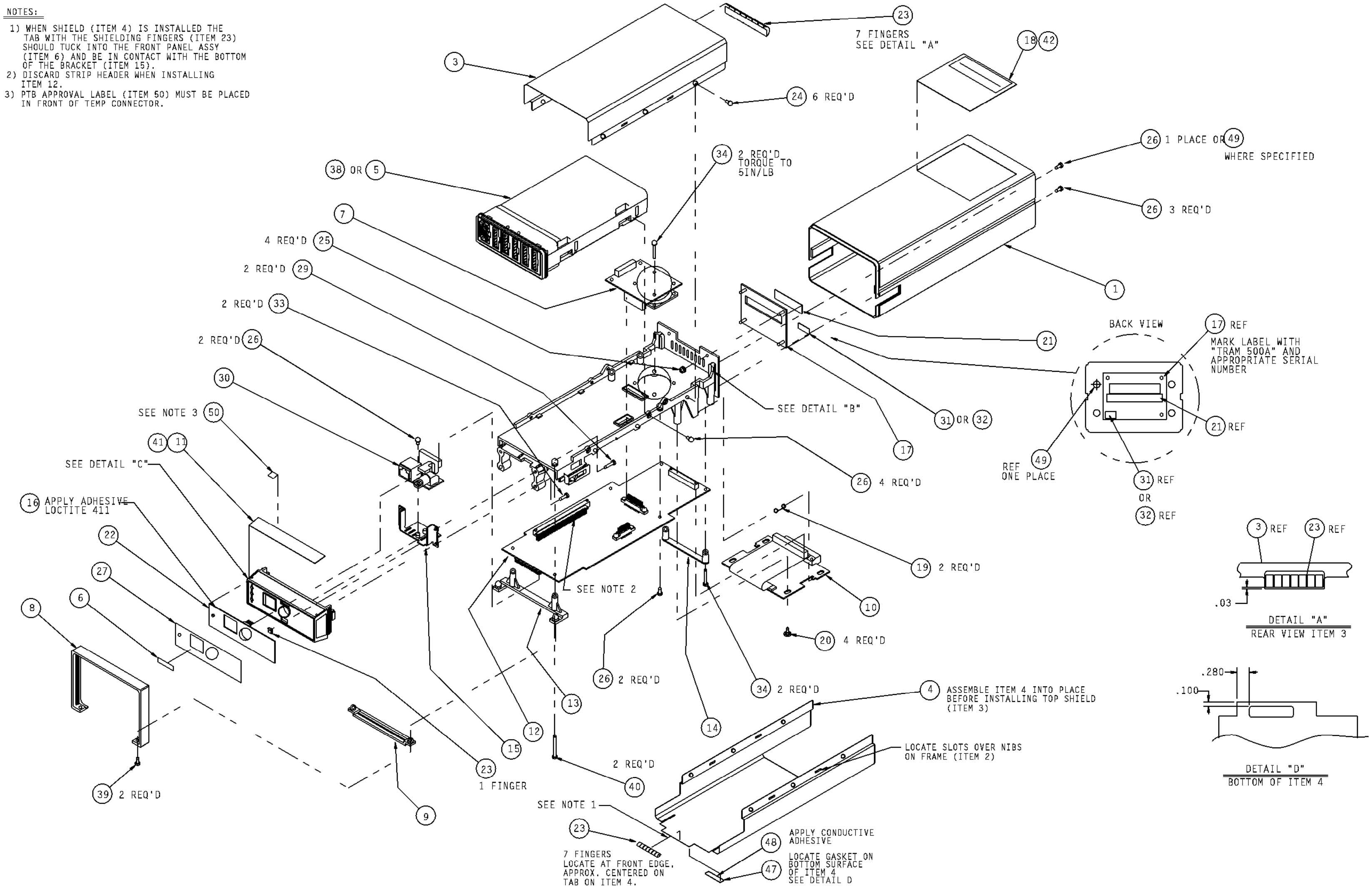
Table 12-2.

Part Number	Rev	Power *f* (Hz)	Labels	Units of Measure
408003-001	B	60	English	English
408003-002	A	50	English	English
408003-003	B	60	English	English
408003-004	A	50	English	English
408003-005	A	60	English	SI
408003-006	A	50	English	SI
408003-007	A	60	English	SI
408003-008	A	50	English	SI
408003-011	A	60	Icon	English
408003-012	A	50	Icon	English
408003-013	A	60	Icon	English
408003-014	A	50	Icon	English
408003-015	A	60	Icon	SI
408003-016	B	50	Icon	SI
408003-017	A	60	Icon	SI
408003-018	B	50	Icon	SI

Part number 408003A without a dashed suffix (ie, pn 408003A, as opposed to pn 408003-001A or pn 408003-002A) refers to all of the assemblies listed in the table above. Unless otherwise noted, all assemblies are the same.

Exploded View PN 408003C

1 of 2

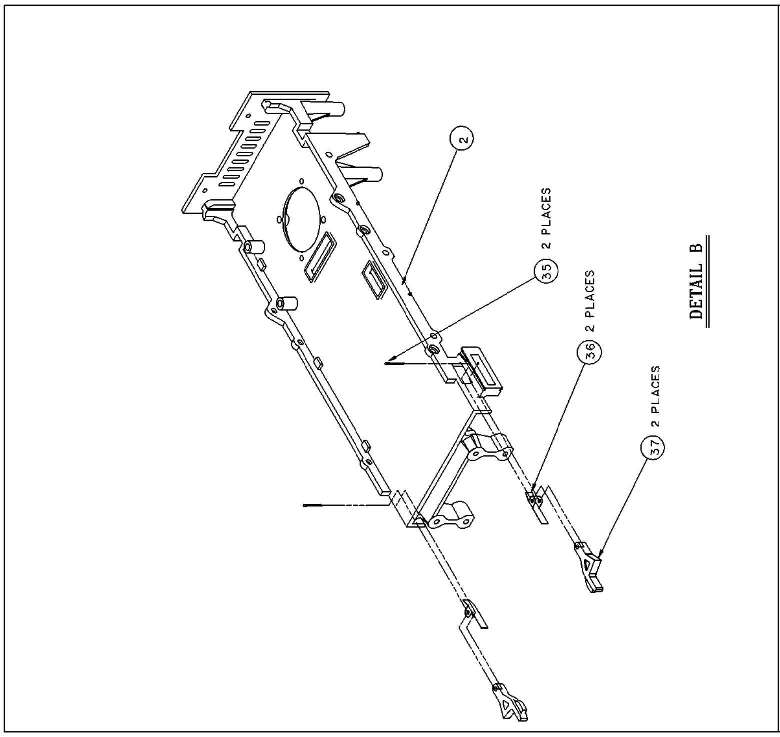


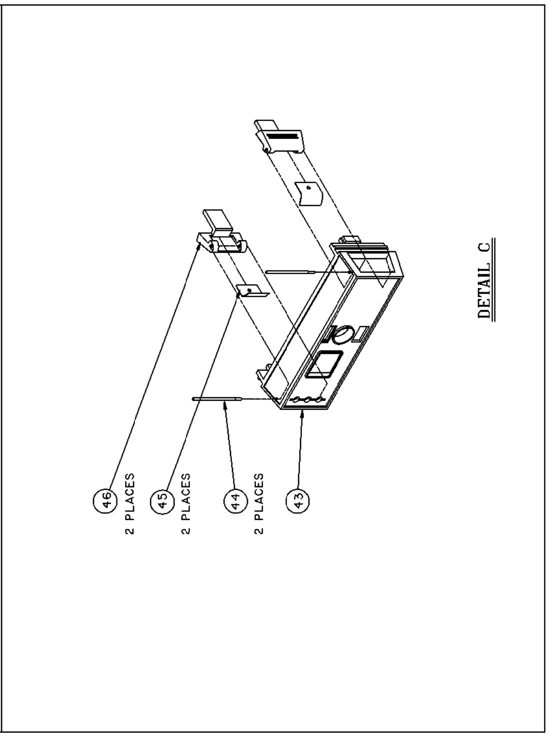
23
7 FINGERS
SEE DETAIL "A"
18 42
3
24 6 REQ'D
26 1 PLACE OR 49
WHERE SPECIFIED
26 3 REQ'D
1
34 2 REQ'D
TORQUE TO
5IN/LB
38 OR 5
7
4 REQ'D 25
2 REQ'D 29
2 REQ'D 33
2 REQ'D 26
30
SEE NOTE 3 50
41 11
SEE DETAIL "C"
16 APPLY ADHESIVE
LOCTITE 411
22
27
6
8
39 2 REQ'D
21
BACK VIEW
17 REF
MARK LABEL WITH
"TRAM 500A" AND
APPROPRIATE SERIAL
NUMBER
21 REF
49
REF
ONE PLACE
31 REF
OR
32 REF
SEE DETAIL "B"
31 OR 32
17
26 4 REQ'D
3 REF
23 REF
.03
DETAIL "A"
REAR VIEW ITEM 3
19 2 REQ'D
10
20 4 REQ'D
SEE NOTE 2
26 2 REQ'D
34 2 REQ'D
4 ASSEMBLE ITEM 4 INTO PLACE
BEFORE INSTALLING TOP SHIELD
(ITEM 3)
.280
.100
DETAIL "D"
BOTTOM OF ITEM 4
13
12
15
14
23
1 FINGER
9
2 REQ'D
40
SEE NOTE 1
LOCATE SLOTS OVER NIBS
ON FRAME (ITEM 2)
23
7 FINGERS
LOCATE AT FRONT EDGE,
APPROX. CENTERED ON
TAB ON ITEM 4.
48 APPLY CONDUCTIVE
ADHESIVE
47 LOCATE GASKET ON
BOTTOM SURFACE
OF ITEM 4
SEE DETAIL D

NOTES:

1) WHEN SHIELD (ITEM 4) IS INSTALLED THE TAB WITH THE SHIELDING FINGERS (ITEM 23) SHOULD TUCK INTO THE FRONT PANEL ASSY (ITEM 6) AND BE IN CONTACT WITH THE BOTTOM OF THE BRACKET (ITEM 15).
2) DISCARD STRIP HEADER WHEN INSTALLING ITEM 12.
3) PTB APPROVAL LABEL (ITEM 50) MUST BE PLACED IN FRONT OF TEMP CONNECTOR.

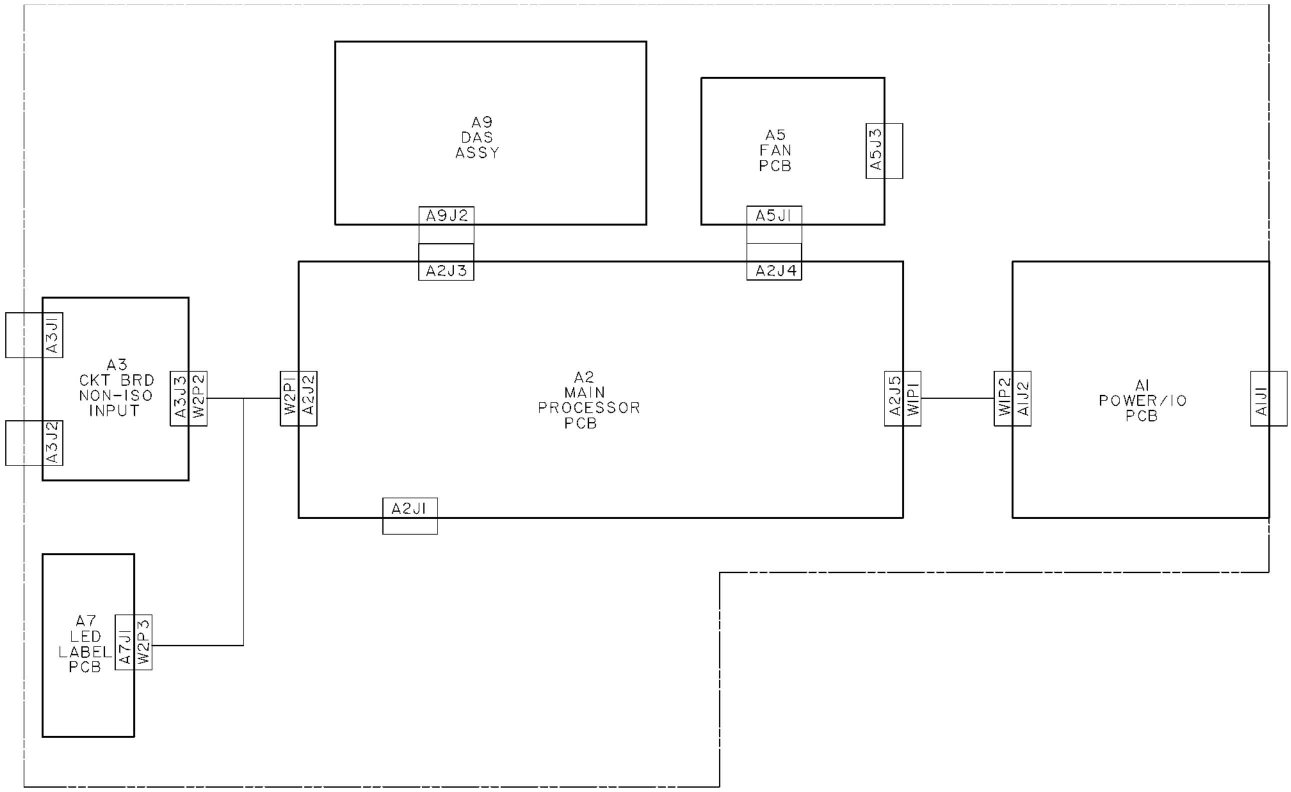
2 of 2

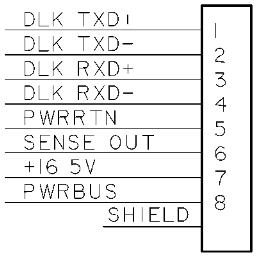

2
35
2 PLACES
36
2 PLACES
37
2 PLACES
DETAIL B


46
2 PLACES
45
2 PLACES
44
2 PLACES
43
DETAIL C

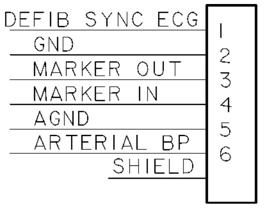
Schematic Diagram PN 408003C

1 of 2

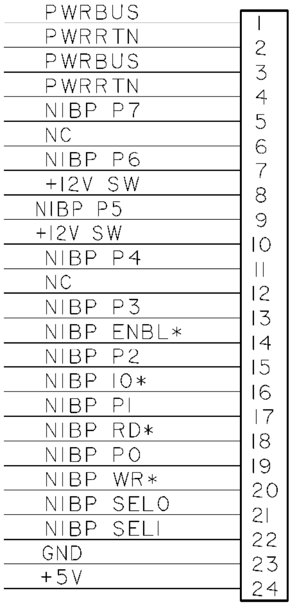

A9
DAS
ASSY
A9J2
A5
FAN
PCB
A5J3
A5J1
A2J3
A2J4
A3J1
A3
CKT BRD
NON-ISO
INPUT
A3J3
W2P2
W2P1
A2J2
A2
MAIN
PROCESSOR
PCB
A2J5
W1P1
W1P2
A1J2
A1
POWER/IO
PCB
A1J1
A3J2
A2J1
A7
LED
LABEL
PCB
A7J1
W2P3


1 DLK TXD+
2 DLK TXD-
3 DLK RXD+
4 DLK RXD-
5 PWRRTN
6 SENSE OUT
7 +16 5V
8 PWRBUS
SHIELD

A3J1

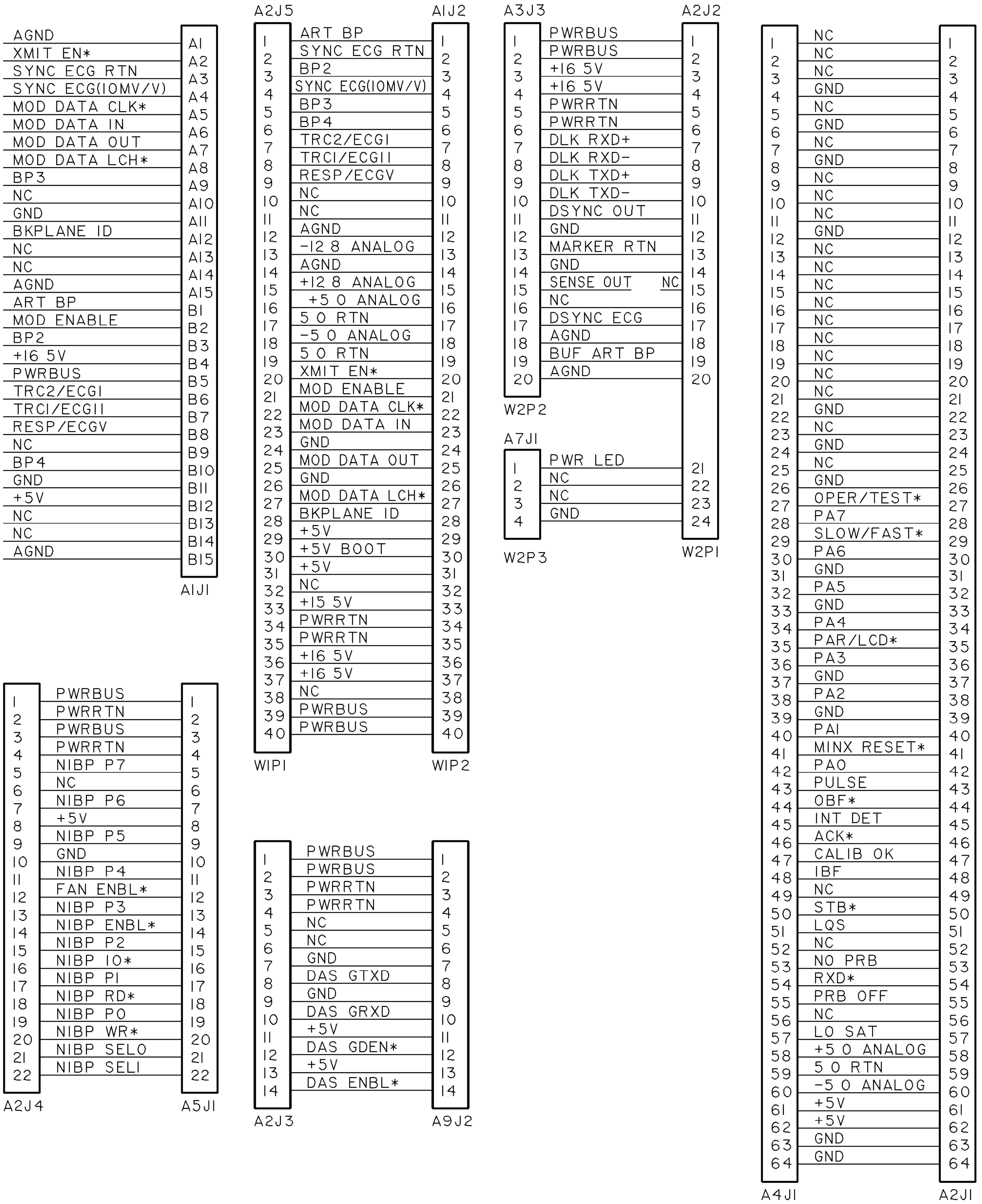

1 DEFIB SYNC ECG
2 GND
3 MARKER OUT
4 MARKER IN
5 AGND
6 ARTERIAL BP
SHIELD

A3J2


1 PWRBUS
2 PWRRTN
3 PWRBUS
4 PWRRTN
5 NIBP P7
6 NC
7 NIBP P6
8 +12V SW
9 NIBP P5
10 +12V SW
11 NIBP P4
12 NC
13 NIBP P3
14 NIBP ENBL*
15 NIBP P2
16 NIBP IO*
17 NIBP P1
18 NIBP RD*
19 NIBP P0
20 NIBP WR*
21 NIBP SEL0
22 NIBP SEL1
23 GND
24 +5V

A5J3

2 of 2



Signal	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD DATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBUS	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J5 W1P1	Signal	A1J2 W1P2
1	ART BP	1
2	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	9
10	NC	10
11	NC	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
15	+12 8 ANALOG	15
16	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	NC	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	NC	38
39	PWRBUS	39
40	PWRBUS	40

A3J3 W2P2	Signal	A2J2 W2P1
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SENSE OUT NC	15
16	NC	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20

A7J1 W2P3	Signal	A2J2 W2P1
1	PWR LED	21
2	NC	22
3	NC	23
4	GND	24

A2J4	Signal	A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	NC	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A2J3	Signal	A9J2
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	NC	5
6	NC	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A4J1	Signal	A2J1
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	NC	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64

Parts List PN 408003C

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3		Shield, Top	401679-001	1
4		Shield, Bottom	401679-002	1
5		500/600 Acquisition Module, 5-Lead	408133-001	*
6		Label, Leadwire Warming	414097-001	*
7		Fan PCB	403549-002	1
8		Trim, Rubber, Front Bezel	404620-001	1
9		Mounting Strap, Trim	404621-001	1
10		Power Supply PCB	401309-002	1
11		Label, Isolated Connector Function, Tram 500A/ 600A, English	402312-001	*
12		Module Processor PCB	800210-001	1
13		Circuit Board/Bezel Mount	404762-001	1
14		Bracket, Power Supply PCB	406254-001	1
15		Plate, Chassis Ground, Bottom/Front	402317-001	1
16		Adhesive, Loctite Prism 411	4851-082	AR
17		Plate, Chassis Ground, Rear	404680-001	1
18		Label, Cover, English	403439-001	*
19		Spring, Compression	402315-001	2
20		Screw, Power Supply PCB Mounting, SST, 4-40	402214-001	4
21		Label, Model/Serial Number	404525-006	1
22		Power Indicator PCB	403170-009	1
23		Spring, Chassis Ground, Rear	403741-001	AR
24		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
25		Nut, Hex, 4-40	4521-304	4
26		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	12
27		Label, Lower Bezel	408162-003	1
29		Screw, 4-40 x 7/8	404069-001	2
30		Non-Isolated Input PCB	401315-002	1
31		Label, 60-Hz	70386-001	*
32		Label, 50-Hz	70386-002	*
33		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
34		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
35		Pin, Latch	406037-001	2
36		Spring, Latch	406019-001	2
37		Latch	401682-001	2
38		500/600 Acquisition Module, 10-Lead	408133-002	*
39		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
40		Screw, BDGH, Phillips, 4-40 x 1-1/8	45074-436	2

Item	Reference Designation	Parts List	Part Number	Qty
41		Label, Isolated Connector Function, Tram 500A/ 600A, Icon	402312-002	*
42		Label, Cover, Icon	403439-002	*
43		Front Bezel, Lower	401105-005	1
44		Pin, Latch	402806-001	2
45		Spring, Flat, SST	405041-001	2
46		Button, Latch	402106-001	2
47		Gasket, Silver-Nickel	407894-001	1
48		Adhesive, Conductive	4851-088	AR
49		Screw, PNHD, 4-40 x 0.188	409009-001	*
50		Label PTB Approval	409047-002	*

*See the following chart:

	Assembly Configuration															
Item	-001	-002	-003	-004	-005	-006	-007	-008	-011	-012	-013	-014	-015	-016	-017	-018
5	1	1	–	–	1	1	–	–	1	1	–	–	1	1	–	–
6	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
11	1	1	1	1	1	1	1	1	–	–	–	–	–	–	–	–
18	1	1	1	1	1	1	1	1	–	–	–	–	–	–	–	–
31	1	–	1	–	1	–	1	–	1	–	1	–	1	–	1	–
38	–	–	1	1	–	–	1	1	–	–	1	1	–	–	1	1
41	–	–	–	–	–	–	–	–	1	1	1	1	1	1	1	1
42	–	–	–	–	–	–	–	–	1	1	1	1	1	1	1	1
49	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
50	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1

Assembly Revisions PN 408003

The baseline revision for this assembly is pn 408003C. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 408003A

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
6		Label, Leadwires Warning	Not Used	414097-001	1
49		Screw, BDGH, 4-40 x 0.188	45074-406	409009-001	*
50		Label, German PTB	Not Used	409047-002	1

PN 408003B

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
6		Label, Leadwires Warning	Not Used	414097-001	1

For your notes

13 TRAM 600A/SL MODULE

PN 408004/411163

General **13-2**
Circuit Boards 13-2
Tram 600A Configurations 13-2

Exploded View PN 408004C **13-3**

Schematic Diagram PN 408004C **13-5**

Parts List PN 408004C **13-7**

Assembly Revisions PN 408004 .... **13-9**

Exploded View PN 411163-001J **13-10**

Schematic Diagram PN 411163-001J **13-12**

Parts List PN 411163-001J **13-14**

Assembly Revisions PN 411163 .... **13-16**

General

Circuit Boards

Details about the circuit boards contained in the Tram 600A/SL are discussed in later chapters arranged by part number.

Table 13-1. Circuit Board Overview

Module Type	Upper Level	Leadwire Configuration	DAS Module	Acquisition Processor PCB	Module Processor PCB
Tram 600A	408004-0XX	5-Leadwire	408133-002	800330-004	800210-005
Tram 600SL	411163-001A–H	10-Leadwire	411168-001	800330-004	800210-005
Tram 600SL	411163-001J	10-Leadwire	417122-001 (Replaced 411168-001)	801040-001	800210-005

Tram 600A Configurations

At the time of this writing, we make 16 configurations of the Tram 600A module. The differences between configurations are in the power frequency, the type of labelling, and the units of measure used. The table below lists the available configurations.

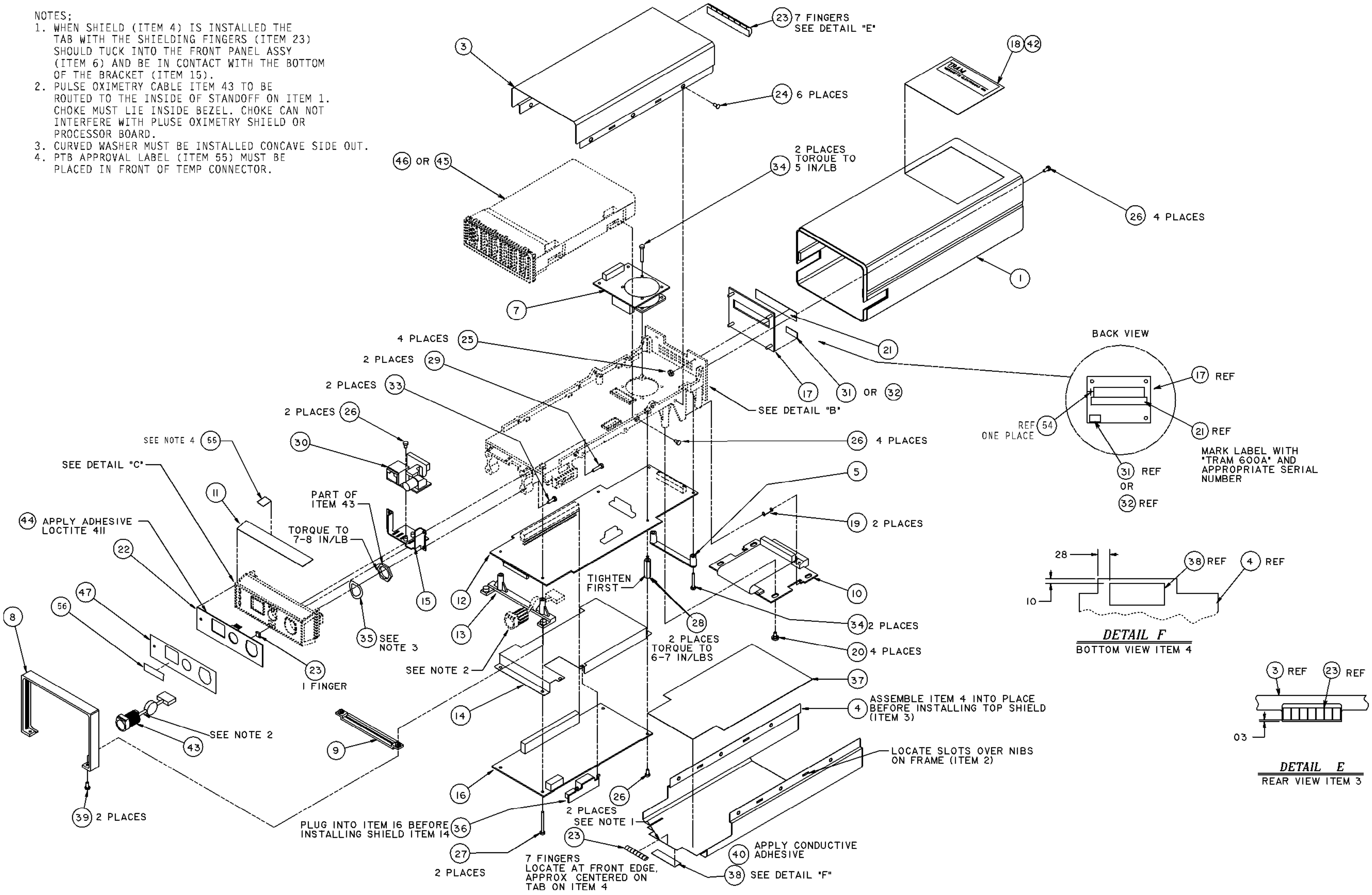
Table 13-2. Configurations

Part Number	Rev	Power f (Hz)	Labels	Units of Measure
408004-001	B	60	English	English
408004-002	A	50	English	English
408004-003	B	60	English	English
408004-004	A	50	English	English
408004-005	A	60	English	SI
408004-006	A	50	English	SI
408004-007	A	60	English	SI
408004-008	A	50	English	SI
408004-011	A	60	Icon	English
408004-012	A	50	Icon	English
408004-013	A	60	Icon	English
408004-014	A	50	Icon	English
408004-015	A	60	Icon	SI
408004-016	B	50	Icon	SI
408004-017	A	60	Icon	SI
408004-018	B	50	Icon	SI

Part number 408004A without a dashed suffix (ie, pn 408004A, as opposed to pn 408004-001A or pn 408004-002A) refers to all of the assemblies listed in the table above. Unless otherwise noted, all assemblies are the same.

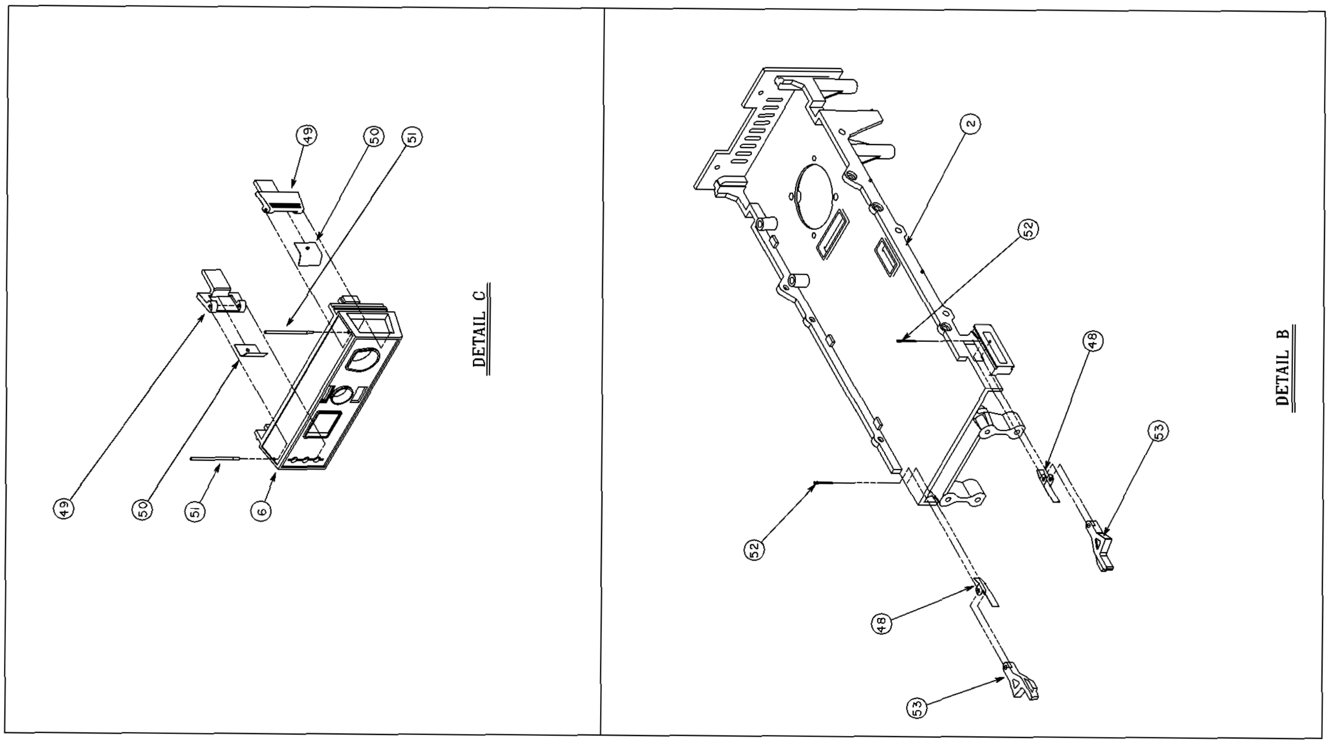
Exploded View PN 408004C

1 of 2


23 7 FINGERS SEE DETAIL "E"
18 42
3
24 6 PLACES
2 PLACES TORQUE TO 5 IN/LB 34
26 4 PLACES
46 OR 45
1
7
21
4 PLACES 25
2 PLACES 29
2 PLACES 33
2 PLACES 26
17
31 OR 32
SEE DETAIL "B"
26 4 PLACES
BACK VIEW
17 REF
21 REF
REF 54 ONE PLACE
31 REF OR 32 REF
MARK LABEL WITH "TRAM 600A" AND APPROPRIATE SERIAL NUMBER
SEE NOTE 4 55
30
SEE DETAIL "C"
11
PART OF ITEM 43
TORQUE TO 7-8 IN/LB
44 APPLY ADHESIVE LOCTITE 411
22
5
19 2 PLACES
10
12
15
TIGHTEN FIRST
28 2 PLACES TORQUE TO 6-7 IN/LBS
34 2 PLACES
20 4 PLACES
13
35 SEE NOTE 3
SEE NOTE 2
47
56
8
23 1 FINGER
14
SEE NOTE 2
43
9
37
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
16
26 2 PLACES SEE NOTE 1
39 2 PLACES
PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14 36
27 2 PLACES
23 7 FINGERS LOCATE AT FRONT EDGE, APPROX CENTERED ON TAB ON ITEM 4
40 APPLY CONDUCTIVE ADHESIVE
38 SEE DETAIL "F"
28
10
38 REF
4 REF
DETAIL F
BOTTOM VIEW ITEM 4
3 REF
23 REF
03
DETAIL E
REAR VIEW ITEM 3

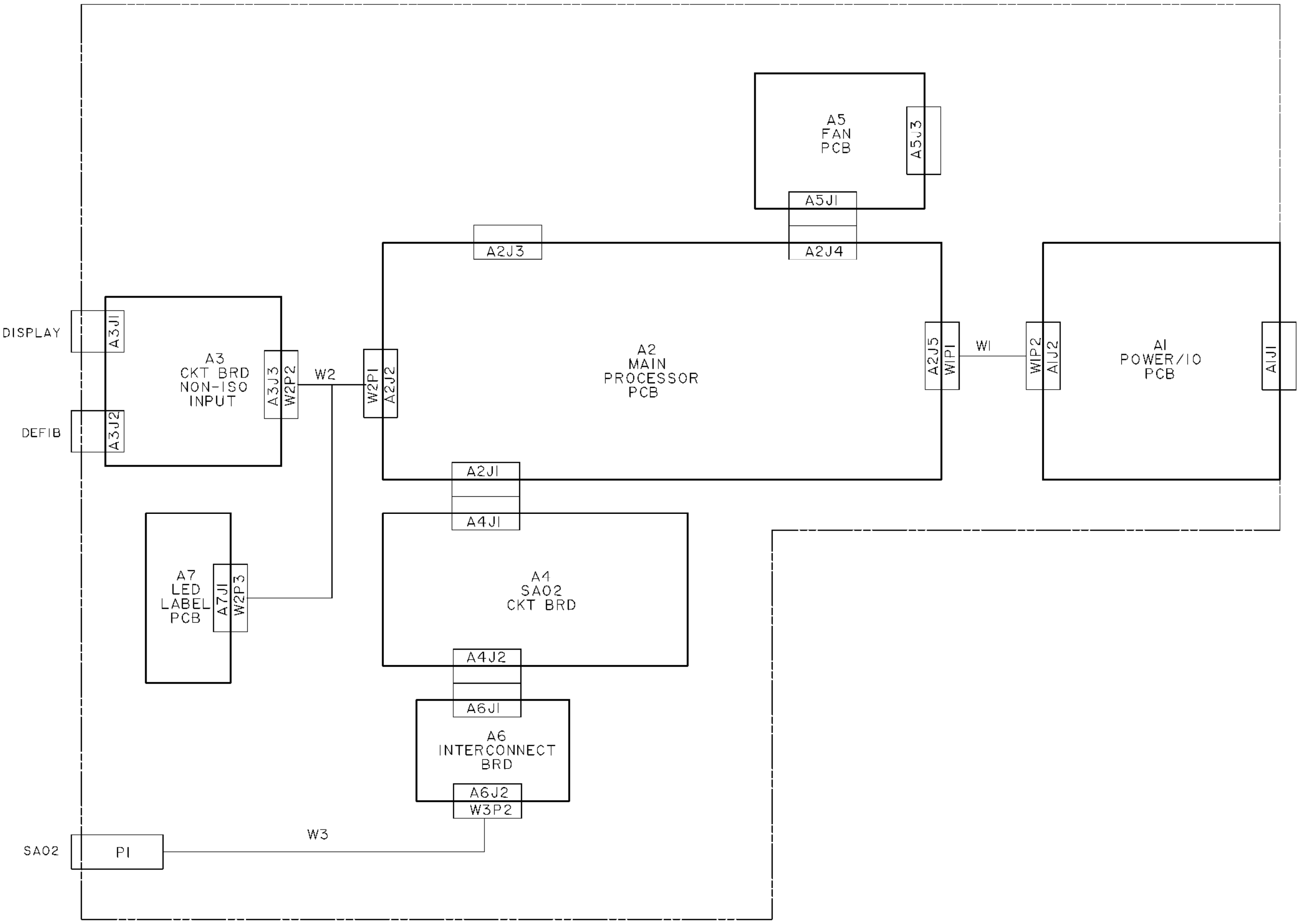
NOTES;
1. WHEN SHIELD (ITEM 4) IS INSTALLED THE TAB WITH THE SHIELDING FINGERS (ITEM 23) SHOULD TUCK INTO THE FRONT PANEL ASSY (ITEM 6) AND BE IN CONTACT WITH THE BOTTOM OF THE BRACKET (ITEM 15).
2. PULSE OXIMETRY CABLE ITEM 43 TO BE ROUTED TO THE INSIDE OF STANDOFF ON ITEM 1. CHOKE MUST LIE INSIDE BEZEL. CHOKE CAN NOT INTERFERE WITH PLUSE OXIMETRY SHIELD OR PROCESSOR BOARD.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. PTB APPROVAL LABEL (ITEM 55) MUST BE PLACED IN FRONT OF TEMP CONNECTOR.

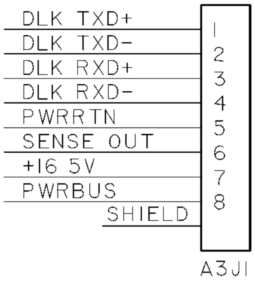
2 of 2

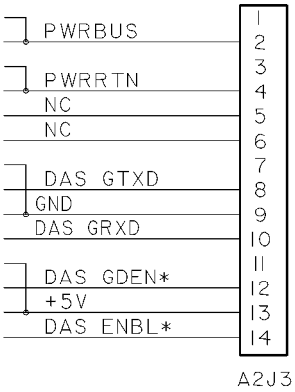

49
50
51
49
50
51
6
DETAIL C
2
52
48
53
52
48
53
DETAIL B

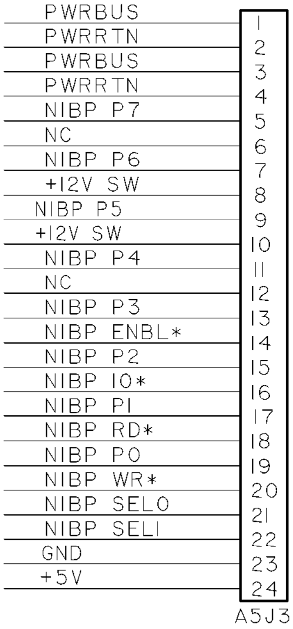
Schematic Diagram PN 408004C

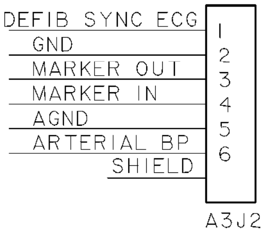
1 of 3


A5
FAN
PCB
A5J3
A5J1
A2J3
A2J4
DISPLAY
A3J1
A3
CKT BRD
NON-ISO
INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2
MAIN
PROCESSOR
PCB
A2J5
W1P1
W1
W1P2
A1J2
A1
POWER/IO
PCB
A1J1
DEFIB
A3J2
A2J1
A4J1
A7
LED
LABEL
PCB
A7J1
W2P3
A4
SA02
CKT BRD
A4J2
A6J1
A6
INTERCONNECT
BRD
A6J2
W3P2
SA02
P1
W3


DLK TXD+
DLK TXD-
DLK RXD+
DLK RXD-
PWRRTN
SENSE OUT
+16 5V
PWRBUS
SHIELD
1
2
3
4
5
6
7
8
A3J1


PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
1
2
3
4
5
6
7
8
9
10
11
12
13
14
A2J3


PWRBUS
PWRRTN
PWRBUS
PWRRTN
NIBP P7
NC
NIBP P6
+12V SW
NIBP P5
+12V SW
NIBP P4
NC
NIBP P3
NIBP ENBL*
NIBP P2
NIBP IO*
NIBP P1
NIBP RD*
NIBP P0
NIBP WR*
NIBP SEL0
NIBP SEL1
GND
+5V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
A5J3


DEFIB SYNC ECG
GND
MARKER OUT
MARKER IN
AGND
ARTERIAL BP
SHIELD
1
2
3
4
5
6
A3J2

2 of 2

	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD DATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBUS	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J4		A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	NC	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A2J5		A1J2
1	ART BP	1
2	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	9
10	NC	10
11	NC	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
15	+12 8 ANALOG	15
16	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	NC	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	NC	38
39	PWRBUS	39
40	PWRBUS	40
W1P1		W1P2

A2J3		A9J2
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	NC	5
6	NC	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A3J3		A2J2
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SENSE OUT NC	15
16	NC	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20
W2P2		

A7J1		
1	PWR LED	21
2	NC	22
3	NC	23
4	GND	24
W2P3		W2P1

		A6J2
8	DETECTOR ANODE	1
9	DETECTOR RTN	2
7	ID RESISTOR COM	3
4	LED ANODES 20 & 30 BIN PROBES	4
3	ID RESISTOR #2	5
5	ID RESISTOR #1	6
6	LED ANODES 300 BIN PROBES	7
2	RED CATHODE	8
1	IR CATHODE	9
	NOT USED	10
W3P1		W3P2

1	DETECTOR ANODE	1
2	DETECTOR RTN	2
3	ID RESISTOR COM	3
4	LED ANODES 20 & 30 BIN PROBES	4
5	ID RESISTOR #2	5
6	ID RESISTOR #1	6
7	LED ANODES 300 BIN PROBES	7
8	RED CATHODE	8
9	IR CATHODE	9
10	NOT USED	10
A6J1		A4J2

1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	NC	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64
A4J1		A2J1

Parts List PN 408004C

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3		Shield, Top	401679-001	1
4		Shield, Bottom	401679-002	1
5		Bracket, Power Supply PCB	406254-001	1
6		Front Bezel, Lower	401105-004	1
7		Fan PCB	403549-002	1
8		Trim, Rubber, Front Bezel	404620-001	1
9		Mounting Strap, Trim	404621-001	1
10		Power Supply PCB	401309-002	1
11		Label, Isolated Connector Function, Tram 500A/ 600A, English	402312-001	*
12		Module Processor PCB	800210-001	1
13		Circuit Board/Bezel Mount	404762-001	1
14		Shield, Pulse Oximetry PCB	401680-001	1
15		Plate, Chassis Ground, Bottom/Front	402317-001	1
16		Pulse Oximetry PCB	401189-001	1
17		Plate, Chassis Ground, Rear	404680-001	1
18		Label, Cover, English	403439-001	*
19		Spring, Compression	402315-001	2
20		Screw, Power Supply PCB Mounting, SST, 4-40	402214-001	4
21		Label, Model/Serial Number	404525-006	1
22		Power Indicator PCB	403170-008	1
23		Spring, Chassis Ground, Rear	403741-001	AR
24		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
25		Nut, Hex, 4-40	4521-304	4
26		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	12
27		Screw, BDGH, Phillips, 4-40 x 1-3/8	45074-438	2
28		Spacer, Male/Female, 4-40 x 0.875	4656-414	2
29		Screw, 4-40 x 7/8	404069-001	2
30		Non-Isolated Input PCB	401315-002	1
31		Label, 60-Hz	70386-001	*
32		Label, 50-Hz	70386-002	*
33		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
34		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
35		Washer, Pulse Oximetry Connector	4550-250	1
36		Interconnect PCB	800006-001	1
37		Insulator, Bottom Shield	404188-001	1
38		Gasket, Silver-Nickel	407894-001	1
39		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
40		Adhesive, Conductive	4851-088	1

Item	Reference Designation	Parts List	Part Number	Qty
41		Label, Isolated Connector Function, Tram 500A/ 600A, Icon	402312-002	*
42		Label, Cover, Icon	403439-002	*
43		Harness, Pulse Oximetry PCB-to-Connector	700091-001	1
44		Adhesive, Loctite Prism 411	4851-082	AR
45		500/600 Acquisition Module, 5-Lead	408133-001	*
46		500/600 Acquisition Module, 10-Lead	408133-002	*
47		Label, Lower Bezel	408162-004	1
48		Spring, Latch	406019-001	2
49		Button, Latch	402106-001	2
50		Spring, Flat, SST	405041-001	2
51		Pin, Latch	402806-001	2
52		Pin, Latch	406037-001	2
53		Latch	401682-001	2
54		Screw, PNHD, 4-40 x 0.188	409009-001	*
55		Label, PTB Approval	409047-002	*
56		Label, PTB Approval	414097-001	*

*See the following chart:

	Assembly Configuration															
Item	-001	-002	-003	-004	-005	-006	-007	-008	-011	-012	-013	-014	-015	-016	-017	-018
11	1	1	1	1	1	1	1	1	–	–	–	–	–	–	–	–
18	1	1	1	1	1	1	1	1	–	–	–	–	–	–	–	–
31	1	–	1	–	1	–	1	–	1	–	1	–	1	–	1	–
32	–	1	–	1	–	1	–	1	–	1	–	1	–	1	–	1
41	–	–	–	–	–	–	–	–	1	1	1	1	1	1	1	1
42	–	–	–	–	–	–	–	–	1	1	1	1	1	1	1	1
45	1	1	–	–	1	1	–	–	1	1	–	–	1	1	–	–
46	–	–	1	1	–	–	1	1	–	–	1	1	–	–	1	1
54	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
54	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
55	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–

Assembly Revisions PN 408004

The baseline revision for this assembly is pn 408004C. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 408004A

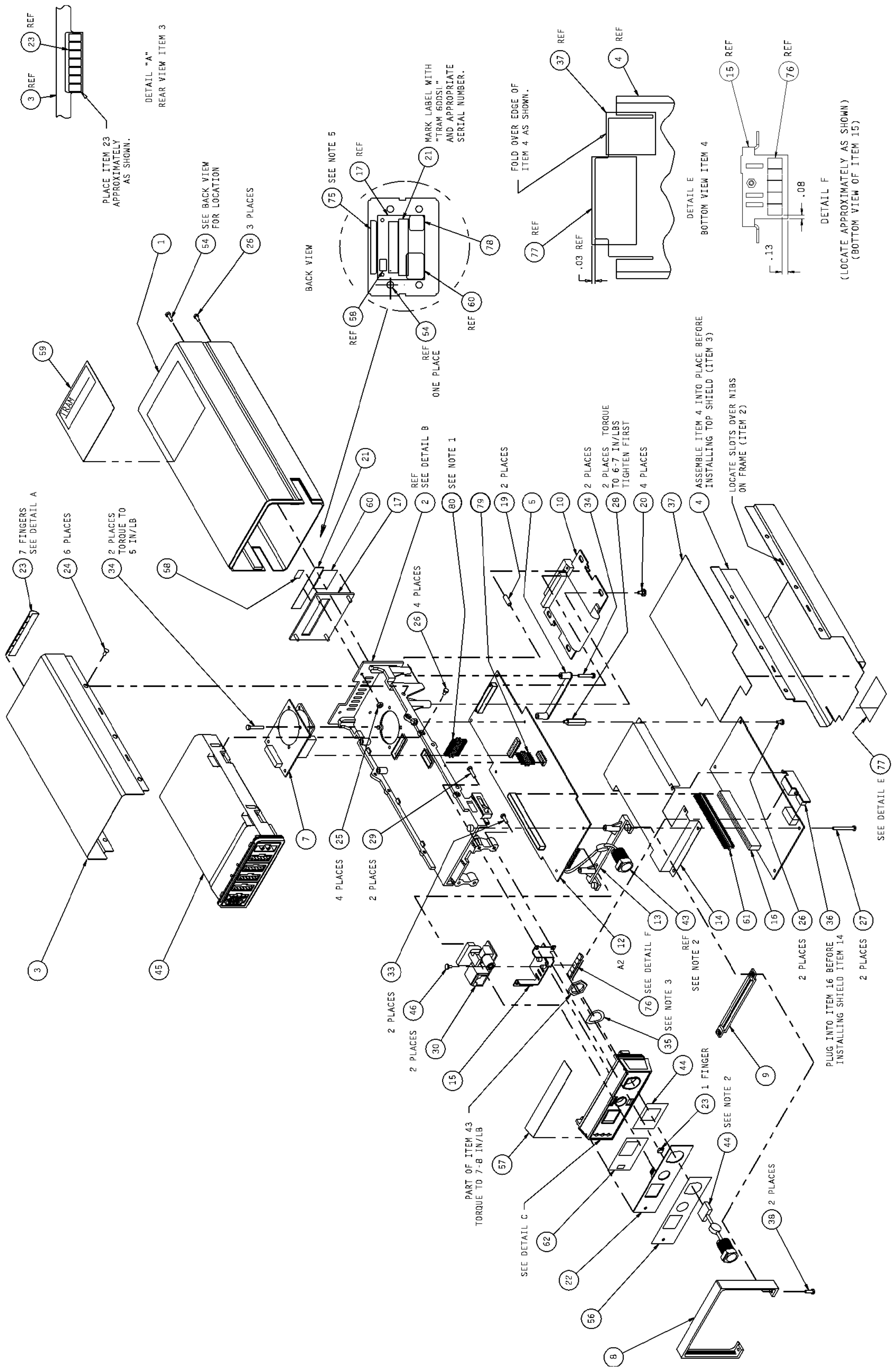
Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
54		Screw, BDGH, 4-40 x 0.188	45074-406	409009-001	*
55		Label, German PTB	Not Used	409047-002	1
56		Label, Leadwires Warning	Not Used	414097-001	1

PN 408004B

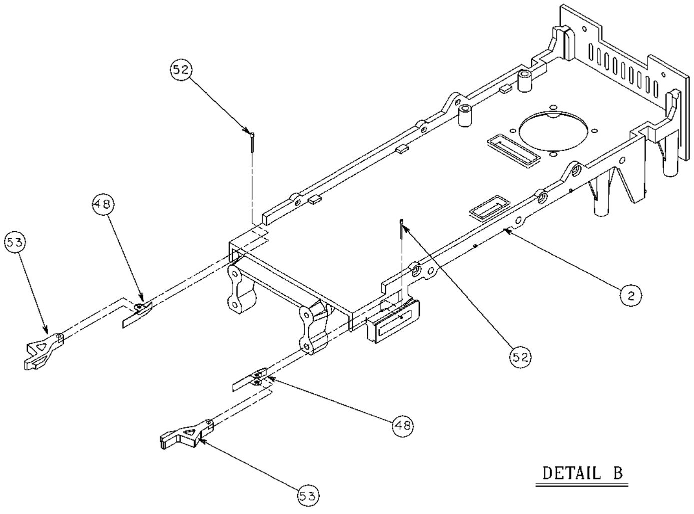
Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
56		Label, Leadwires Warning	Not Used	414097-001	1

Exploded View PN 411163-001J

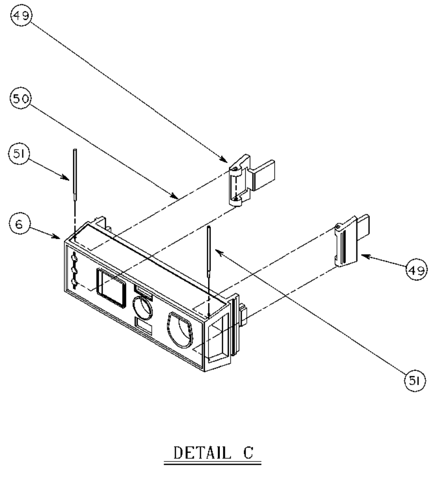
1 of 2


23 REF
3 REF
DETAIL "A"
REAR VIEW ITEM 3
PLACE ITEM 23 APPROXIMATELY AS SHOWN.
MARK LABEL WITH "TRAM 600SL" AND APPROPRIATE SERIAL NUMBER.
FOLD OVER EDGE OF ITEM 4 AS SHOWN.
37 REF
4 REF
77 REF
.03 REF
DETAIL E
BOTTOM VIEW ITEM 4
15 REF
76 REF
.08
.13
DETAIL F
(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 15)
BACK VIEW
75 SEE NOTE 5
17 REF
21
78
60 REF
54 REF ONE PLACE
58 REF
1
54 SEE BACK VIEW FOR LOCATION
26 3 PLACES
59
TRAM
21
60
17
2 REF SEE DETAIL B
80 SEE NOTE 1
79
19 2 PLACES
5
10
34 2 PLACES
28 2 PLACES TORQUE TO 6-7 IN/LBS TIGHTEN FIRST
20 4 PLACES
37
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
23 7 FINGERS SEE DETAIL A
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
58
26 4 PLACES
77 SEE DETAIL E
7
25 4 PLACES
29 2 PLACES
3
45
33
13
43 REF SEE NOTE 2
12 A2
14
61
16
26 2 PLACES
36 PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
27 2 PLACES
76 SEE DETAIL F
35 SEE NOTE 3
46 2 PLACES
30 2 PLACES
15
9
44
23 1 FINGER
44 SEE NOTE 2
57
PART OF ITEM 43 TORQUE TO 7-8 IN/LB
SEE DETAIL C
62
22
56
38 2 PLACES
8

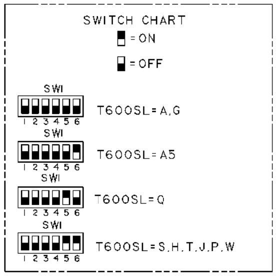
2 of 2

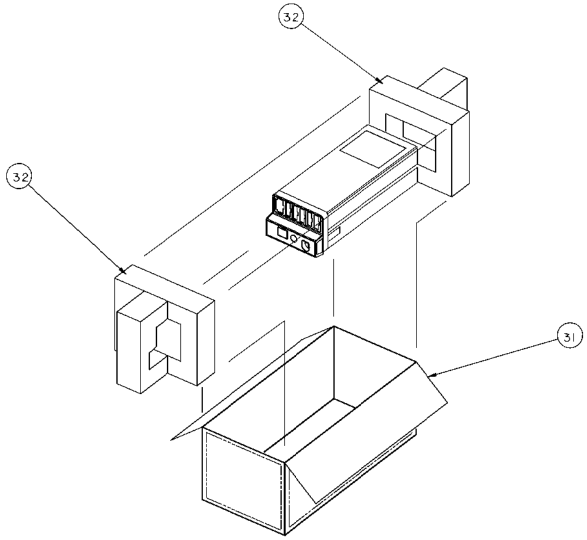

52
48
53
2
52
48
53

DETAIL B


49
50
51
6
49
51

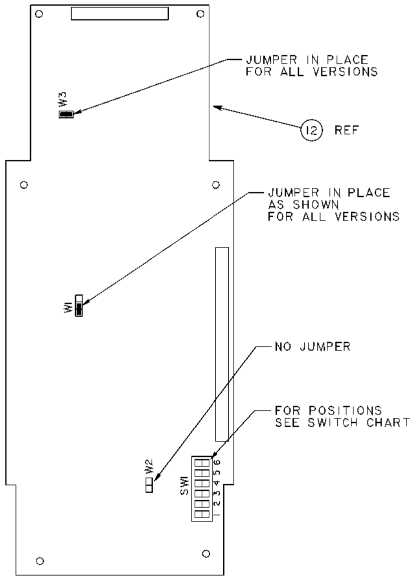
DETAIL C


SWITCH CHART
= ON
= OFF
SWI
1 2 3 4 5 6
T600SL=A,G
SWI
1 2 3 4 5 6
T600SL=A5
SWI
1 2 3 4 5 6
T600SL=Q
SWI
1 2 3 4 5 6
T600SL=S,H,T,J,P,W



NOTES;

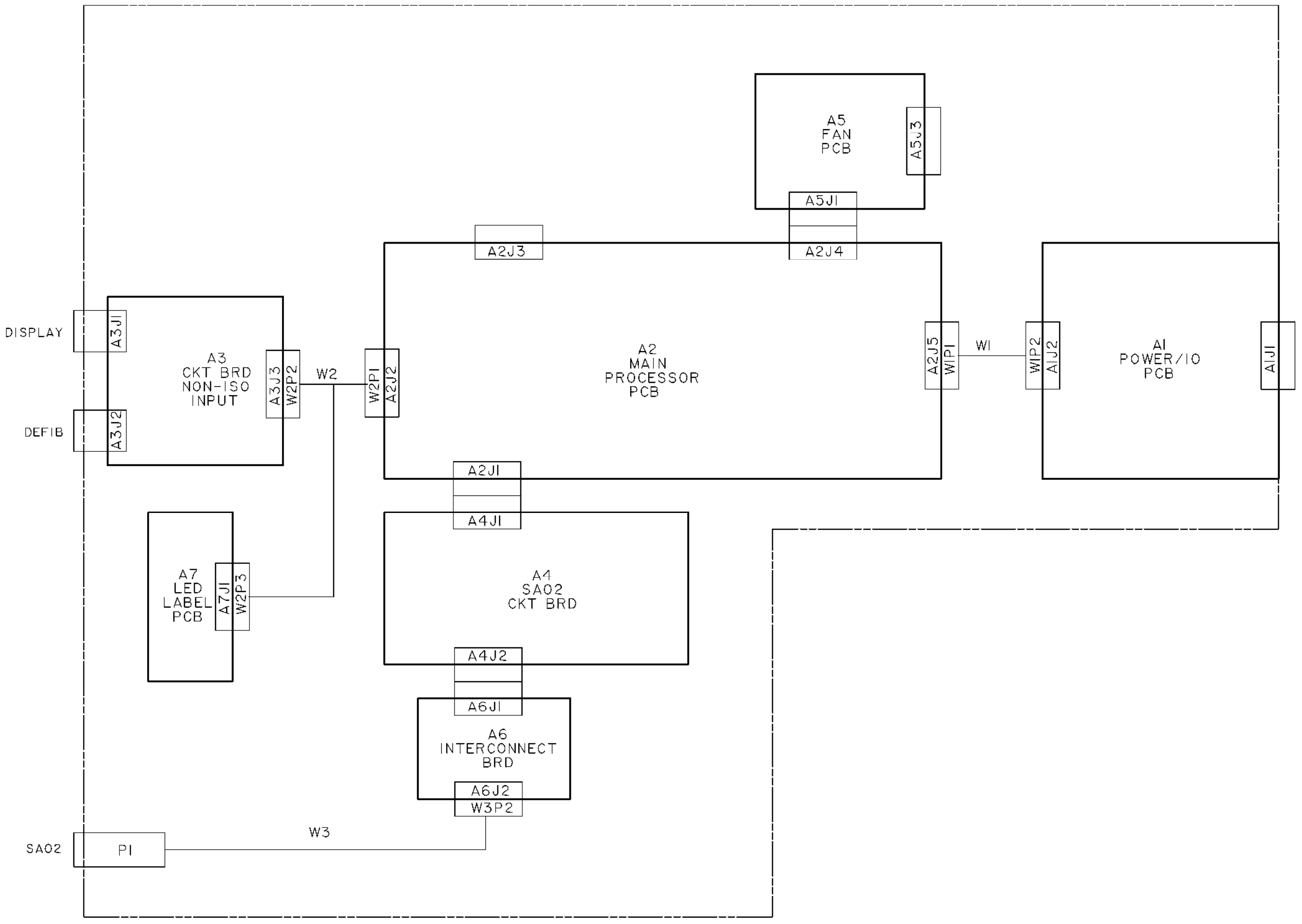
1. INSERT LONGER PIN SIDE INTO ITEM 12. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 12 WHEN ASSEMBLED.
1. PULSE OXIMETRY CABLE ITEM 43 TO BE ROUTED TO THE INSIDE OF FIRST STANDOFF ON ITEM 13, THEN BEHIND NON-ISO INPUT PCB (ITEM 30) FLEX CIRCUIT CONNECTOR AND LASTLY TO THE INSIDE OF SECOND STANDOFF ON ITEM 13.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. SWITCH SETTING MUST BE MADE FOR EACH CONFIGURATION. SEE PRODUCT LEVEL NOTE. (REFER TO SWITCH CHART)
5. MARK LABEL ITEM 75, AS FOLLOWS: ZULASSUNGSKENNZEICHEN: 01/M-305/94.
6. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
7. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.

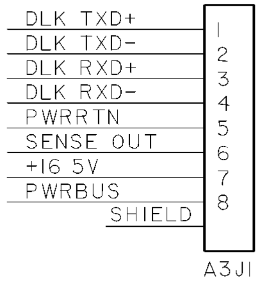

JUMPER IN PLACE FOR ALL VERSIONS
W3
12 REF
JUMPER IN PLACE AS SHOWN FOR ALL VERSIONS
W1
NO JUMPER
W2
FOR POSITIONS SEE SWITCH CHART
SWI
1 2 3 4 5 6

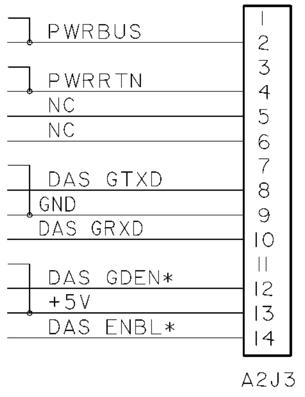
BOTTOM VIEW ITEM 12

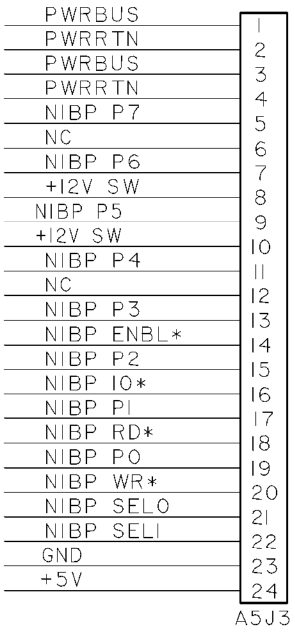
Schematic Diagram PN 411163-001J

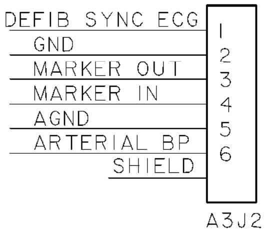
1 of 2


A5
FAN
PCB
A5J3
A5J1
A2J3
A2J4
DISPLAY
A3J1
A3
CKT BRD
NON-ISO
INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2
MAIN
PROCESSOR
PCB
A2J5
W1P1
W1
W1P2
A1J2
A1
POWER/IO
PCB
A1J1
DEFIB
A3J2
A2J1
A4J1
A7
LED
LABEL
PCB
A7J1
W2P3
A4
SA02
CKT BRD
A4J2
A6J1
A6
INTERCONNECT
BRD
A6J2
W3P2
SA02
P1
W3

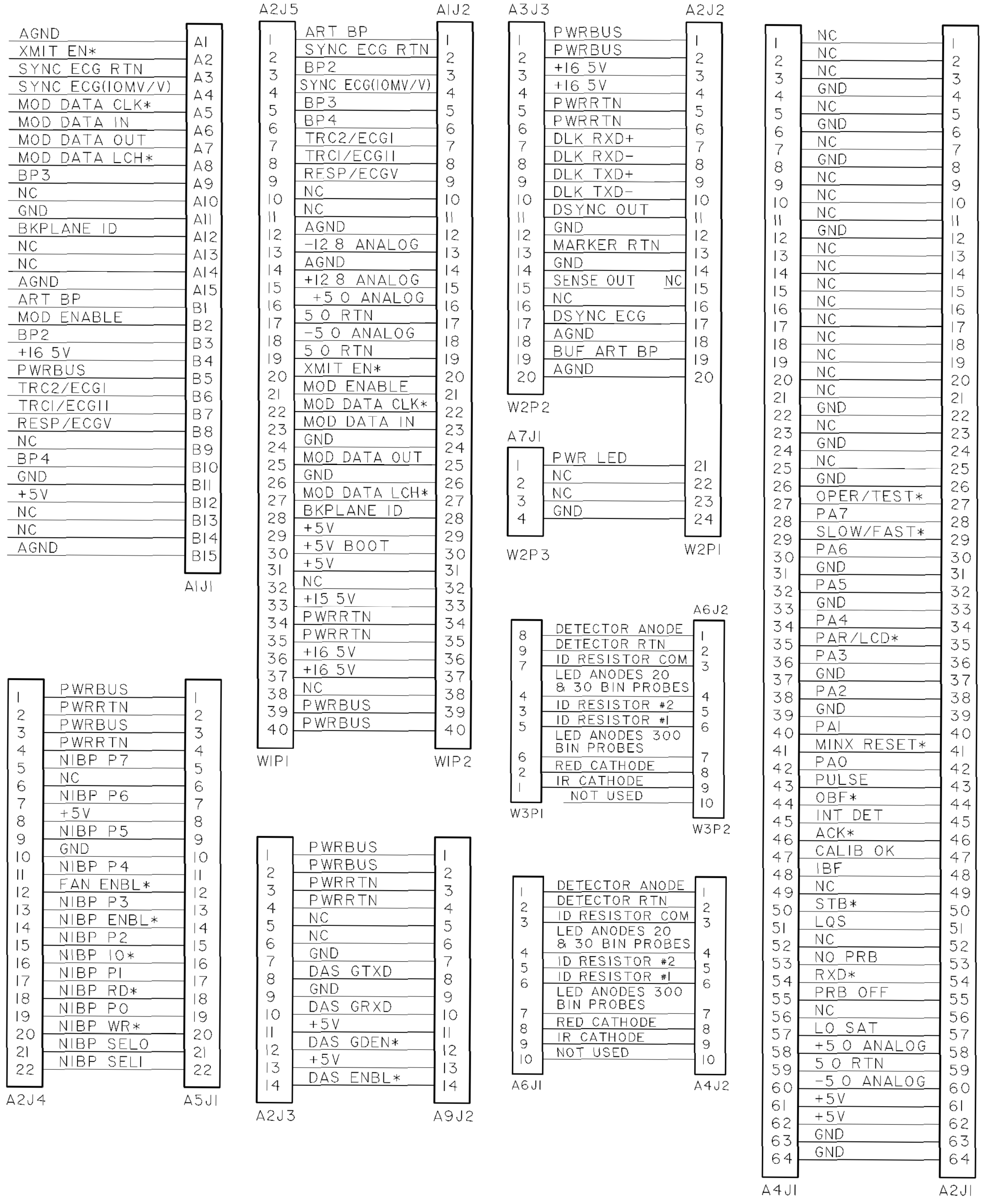

DLK TXD+
DLK TXD-
DLK RXD+
DLK RXD-
PWRRTN
SENSE OUT
+16 5V
PWRBUS
SHIELD
1
2
3
4
5
6
7
8
A3J1


PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
1
2
3
4
5
6
7
8
9
10
11
12
13
14
A2J3


PWRBUS
PWRRTN
PWRBUS
PWRRTN
NIBP P7
NC
NIBP P6
+12V SW
NIBP P5
+12V SW
NIBP P4
NC
NIBP P3
NIBP ENBL*
NIBP P2
NIBP IO*
NIBP P1
NIBP RD*
NIBP P0
NIBP WR*
NIBP SEL0
NIBP SEL1
GND
+5V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
A5J3


DEFIB SYNC ECG
GND
MARKER OUT
MARKER IN
AGND
ARTERIAL BP
SHIELD
1
2
3
4
5
6
A3J2

2 of 2



Signal	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD DATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBUS	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J5 (W1P1)	Signal	A1J2 (W1P2)
1	ART BP	1
2	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	9
10	NC	10
11	NC	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
15	+12 8 ANALOG	15
16	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	NC	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	NC	38
39	PWRBUS	39
40	PWRBUS	40

A3J3 (W2P2)	Signal	A2J2 (W2P1)
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SENSE OUT NC	15
16	NC	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20

A7J1 (W2P3)	Signal	A2J2 (W2P1)
1	PWR LED	21
2	NC	22
3	NC	23
4	GND	24

W3P1	Signal	A6J2 (W3P2)
8	DETECTOR ANODE	1
9	DETECTOR RTN	2
7	ID RESISTOR COM	3
4	LED ANODES 20 & 30 BIN PROBES	4
3	ID RESISTOR #2	5
5	ID RESISTOR #1	6
6	LED ANODES 300 BIN PROBES	7
2	RED CATHODE	8
1	IR CATHODE	9
	NOT USED	10

A6J1	Signal	A4J2
1	DETECTOR ANODE	1
2	DETECTOR RTN	2
3	ID RESISTOR COM	3
4	LED ANODES 20 & 30 BIN PROBES	4
5	ID RESISTOR #2	5
6	ID RESISTOR #1	6
7	LED ANODES 300 BIN PROBES	7
8	RED CATHODE	8
9	IR CATHODE	9
10	NOT USED	10

A2J4	Signal	A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	NC	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP 10*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A2J3	Signal	A9J2
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	NC	5
6	NC	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A4J1	Signal	A2J1
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	NC	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64

Parts List PN 411163-001J

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3		Shield, Top	401679-001	1
4		Shield, Bottom	401679-002	1
5		Bracket, Power Supply PCB	406254-001	1
6		Front Bezel, Lower	401105-004	1
7	A5	Fan PCB	403549-002	1
8		Trim, Rubber, Front Bezel	404620-001	1
9		Mounting Strap, Trim	404621-001	1
10	A1	Power Supply PCB	401309-002	1
12	A2	Module Processor PCB	800210-005	1
13		Circuit Board/Bezel Mount	404762-001	1
14		Shield, Pulse Oximetry PCB	401680-001	1
15		Plate, Chassis Ground, Bottom/Front	402317-001	1
16	A4	Pulse Oximetry PCB	401189-001	1
17		Plate, Chassis Ground, Rear	404680-001	1
18		Tram 100 - 800 A & SL Modules Service Manual	404422-065	AR
19		Spring, Compression	402315-001	2
20		Screw, Power Supply PCB Mounting, SST, 4-40	402214-001	4
21		Label, Model/Serial Number	404525-006	1
22	A7	Power Indicator PCB	403170-008	1
23		Spring, Chassis Ground, Rear	403741-001	AR
24		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
25		Nut, Hex, 4-40	4521-304	4
26		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	12
27		Screw, BDGH, Phillips, 4-40 x 1-3/8	45074-438	2
28		Spacer, Male/Female, 4-40 x 0.875	4656-414	2
29		Screw, 4-40 x 7/8	404069-001	2
30	A3	Non-Isolated Input PCB	401315-002	1
31		Carton, Shipping	404211-003	1
32		Foam Insert	404211-004	2
33		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
34		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
35		Washer, Pulse Oximetry Connector	4550-250	1
36	A6	Interconnect PCB	800006-001	1
37		Insulator, Bottom Shield	404188-001	1
39		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
43	P1, W3	Harness Assembly, SpO_2 – w/Choke	700091-004	1
44		Adhesive, Diecut, Front Right	415098-001	1
45	A9	600 Acquisition Module	417122-001	1
46		Screw, PNH, Phillips, SST, 4-40 x 3/16	4502-406	2

Item	Reference Designation	Parts List	Part Number	Qty
48		Spring, Latch	406019-001	2
49		Button, Latch	402106-001	1
51		Pin, Latch	402806-001	2
52		Pin, Latch	406037-001	2
53		Latch	401682-001	1
54		Screw, PNH, 4-40 x 0.188, Modified (Determined by Destination)	409009-001	1
54		Screw, BDGH, 4-40 x 0.188 (Determined by Destination)	45075-406	1
56		Label, Front, 600SL, English (Determined by Destination)	411175-002	1
56		Label, Front, 600SL, German (Determined by Destination)	411175-003	1
56		Label, Front, 600SL, French (Determined by Destination)	411175-004	1
56		Label, Front, 600SL, Swedish (Determined by Destination)	411175-005	1
56		Label, Front, 600SL, Spanish (Determined by Destination)	411175-006	1
56		Label, Front, 600SL, Italian (Determined by Destination)	411175-007	1
57		Label, Top, English (Determined by Destination)	411175-009	1
57		Label, Top, German (Determined by Destination)	411175-010	1
57		Label, Top, French (Determined by Destination)	411175-011	1
57		Label, Top, Swedish (Determined by Destination)	411175-012	1
57		Label, Top, Spanish (Determined by Destination)	411175-013	1
57		Label, Top, Italian (Determined by Destination)	411175-014	1
59		Label, Cover, English (Determined by Destination)	411175-016	1
59		Label, Cover, German (Determined by Destination)	411175-020	1
59		Label, Cover, French (Determined by Destination)	411175-021	1
59		Label, Cover, Swedish (Determined by Destination)	411175-022	1
59		Label, Cover, Spanish (Determined by Destination)	411175-023	1
59		Label, Cover, French (Determined by Destination)	411175-024	1
59		Label, Cover, International (Determined by Destination)	411173-025	1
60		Label, TUV (Determined by Destination)	408103-003	1
60		Label, UL (Determined by Destination)	408230-002	1
61	P1	Connector, Header, 64-Pin, w/Ferrites	409203-001	1
62		Adhesive, Diecut, Front Left	415098-002	1
76		Spring, Chassis Ground, Small	414610-001	AR
77		Adhesive, Mylar	415316-001	1
78		Label, CE Mark	408230-008	1
79		PC Post, 2 x 7	412062-004	1
80		PC Post, 2 x 11	412062-005	1

Assembly Revisions PN 411163

The baseline revision for this assembly is pn 411163-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 411163-001B

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
11		Label Set, Tram 600SL	411175-001	Not Used	1
12		Module Processor PCB	800210-002	800210-005	1
44		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
45	A9	DAS 600 Module, 10-Lead	411168-001	417122-001	1
46		Screw, Phillips, STT, 4-40 x 3/16	Not Used	4502-406	2
61		Connector, Header 64-pin w/Ferrites	Not Used	409203-001	1
62		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411163-001C

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
12		Module Processor PCB	800210-002	800210-005	1
44		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
45	A9	DAS 600 Module, 10-Lead	411168-001	417122-001	1
62		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411163-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 411163-001C for changes to the parts list.

PN 411163-001E

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
12		Module Processor PCB	800210-002	800210-005	1
45	A9	DAS 600 Module, 10-Lead	411168-001	417122-001	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411163-001F

This revision was a documentation change that does not affect this manual.
Refer to pn 411163-001E for changes to the parts list.

PN 411163-001G

This revision was a documentation change that does not affect this manual.
Refer to pn 411163-001E for changes to the parts list.

PN 411163-001H

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
45	A9	DAS 600 Module, 10-Lead	411168-001	417122-001	1

For your notes

14 TRAM 650SL MODULE
PN 412656

General **14-2**
Circuit Boards 14-2

Exploded View PN 412656-001H **14-3**

Schematic Diagram PN 412656-001H **14-5**

Parts List PN 412656-001H **14-7**

ssembly Revisions PN 412656 .... **14-9**

General

Circuit Boards

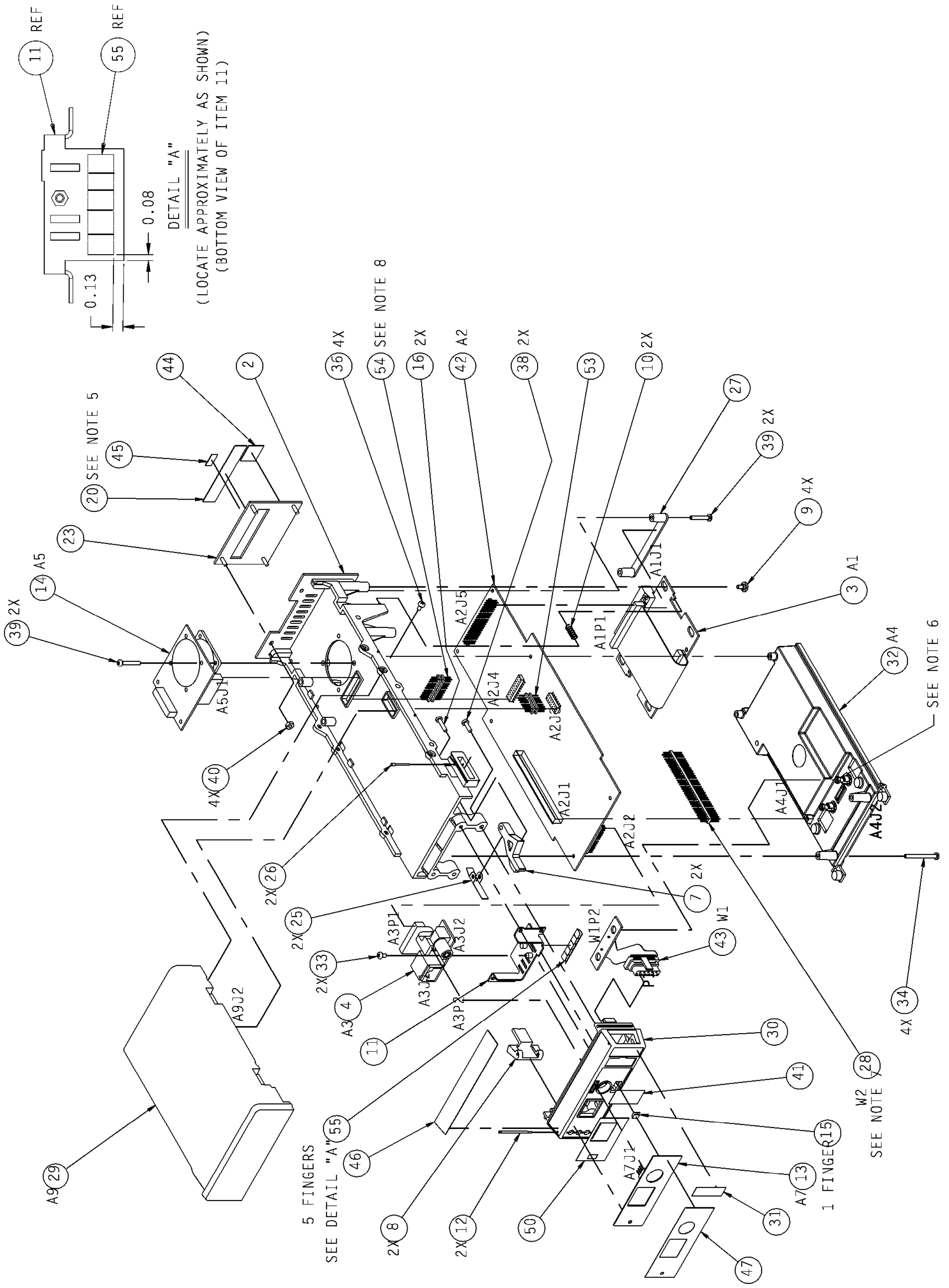
Details about the circuit boards contained in the Tram 650SL are discussed in later chapters arranged by part number.

Table 14-1. Circuit Board Overview

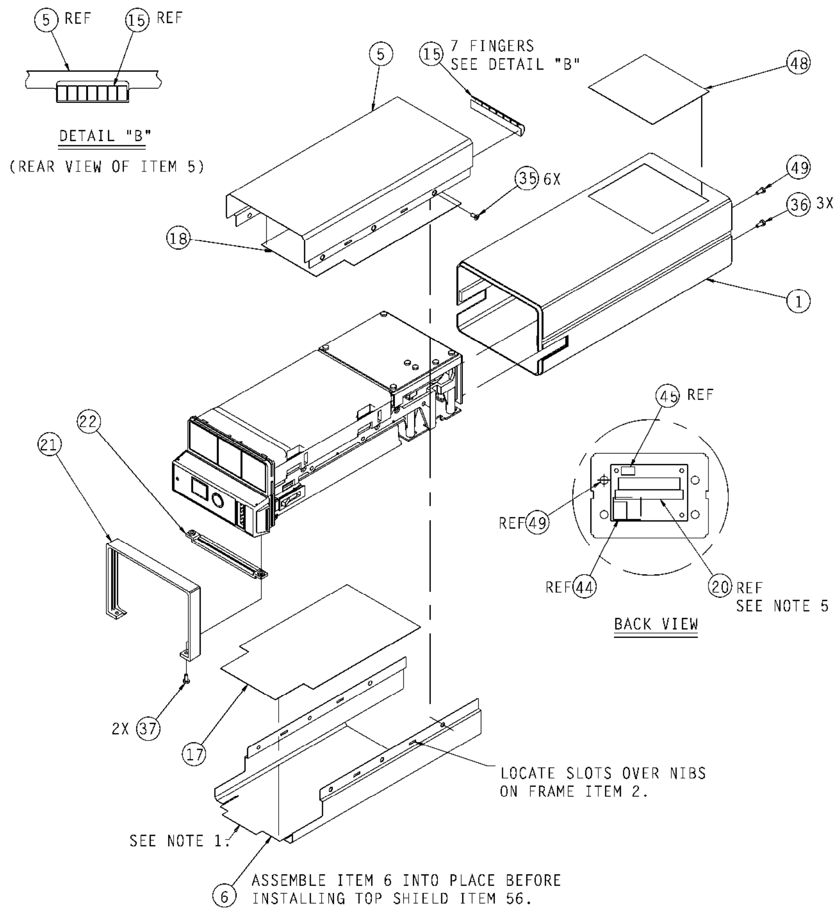
Module Type	Upper Level	Leadwire Configuration	DAS Module	Acquisition Processor PCB	Module Processor PCB
Tram 650SL	412656-001A–G	10-Leadwire	411168-001	800330-004	800210-005
Tram 650SL	412656-001H	10-Leadwire	417122-001 (Replaced 411168-001)	801040-001	800210-005

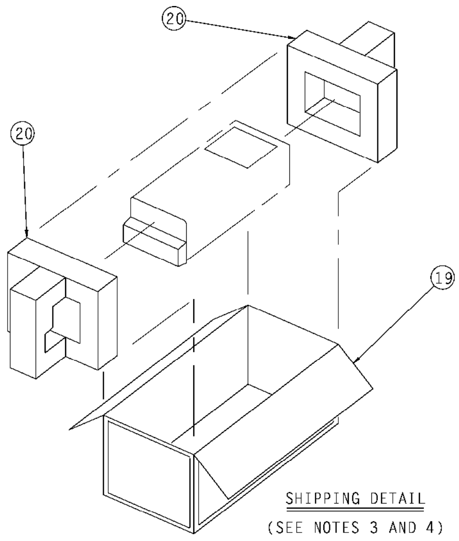
Exploded View PN 412656-001H

1 of 2


11 REF
55 REF
0.13
0.08
DETAIL "A"
(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 11)
44
2
36 4X
54 SEE NOTE 8
16 2X
42 A2
38 2X
53
10 2X
27
39 2X
9 4X
3 A1
A1J1
A1P1
32 A4
SEE NOTE 6
A4J1
A4J2
34 4X
45
20 SEE NOTE 5
23
14 A5
39 2X
A5J1
A2J5
A2J4
A2J3
A2J1
A2J2
40 4X
26 2X
25 2X
7 2X
W1P2
43 W1
A3P1
A3J2
33 2X
4 A3
A3J1
A3P2
11
W2 28
SEE NOTE 7
30
41
15
13 A7
1 FINGER
A7J1
31
47
50
12 2X
8 2X
46
55
5 FINGERS
SEE DETAIL "A"
A9J2
29 A9

2 of 2

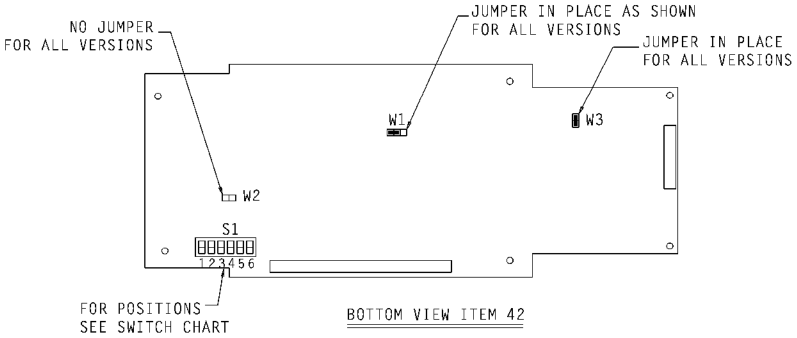

5 REF
15 REF
DETAIL "B"
(REAR VIEW OF ITEM 5)
5
15 7 FINGERS
SEE DETAIL "B"
48
35 6X
49
36 3X
18
1
45 REF
22
21
REF 49
REF 44
20 REF
SEE NOTE 5
BACK VIEW
2X 37
17
LOCATE SLOTS OVER NIBS
ON FRAME ITEM 2.
SEE NOTE 1.
6 ASSEMBLE ITEM 6 INTO PLACE BEFORE
INSTALLING TOP SHIELD ITEM 56.


20
20
19
SHIPPING DETAIL
(SEE NOTES 3 AND 4)

SWITCH CHART
(SEE NOTE 2)

▀ =ON
▄ =OFF

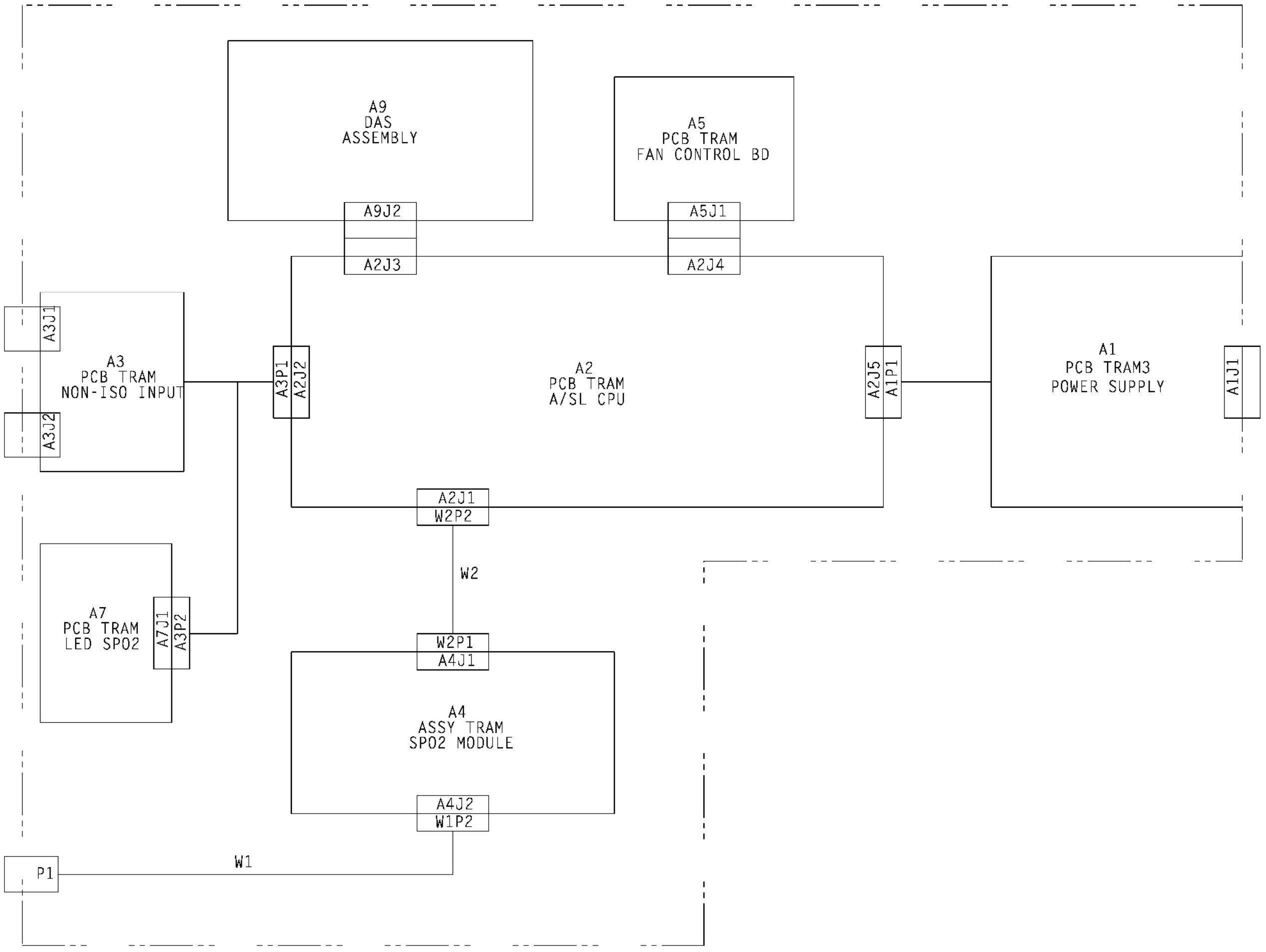
DESCRIPTION	SW1 123456	OMAR NUMBER
ENG 60HZ	▄▄▄▄▄▄	T650 =A,G
ENG 50HZ	▄▄▄▄▄▀	T650 =A5
SI 60HZ	▄▄▄▄▀▄	T650 =Q
SI 50HZ	▄▄▄▄▀▀	T650 =S,H, T,J, P,W

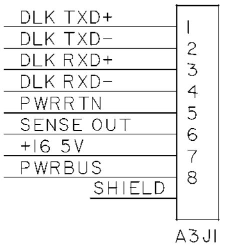

NO JUMPER
FOR ALL VERSIONS
JUMPER IN PLACE AS SHOWN
FOR ALL VERSIONS
JUMPER IN PLACE
FOR ALL VERSIONS
W1
W2
W3
S1
123456
FOR POSITIONS
SEE SWITCH CHART
BOTTOM VIEW ITEM 42

NOTES:
1. WHEN SHIELD (ITEM 6) IS INSTALLED, THE TAB SHOULD TUCK INTO THE FRONT BEZEL (ITEM 30) AND BE IN CONTACT WITH THE SHIELDING FINGERS (ITEM 15) ON THE BOTTOM OF THE BRACKET (ITEM 11).
2. SWITCH SETTINGS MUST BE MADE FOR EACH CONFIGURATION (SEE SWITCH CHART).
3. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
4. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.
5. MARK LABEL WITH "TRAM 650SL", SERIAL NUMBER, AND BAR CODE.
6. INSERT TWO HOLES OF FLEX PCB (ITEM 43) ONTO 1/4-TURN STANDOFF (ITEM 32) UNTIL CONNECTOR ON PCB FLEX BOTTOMS OUT. THEN LOCK THE STANDOFFS BY TURNING THE HEX SCREW OF THE STANDOFF 1/4-TURN CLOCKWISE.
7. INSERT THE SHORT LEADS OF CONNECTOR (ITEM 28) INTO PCB TRAM CPU (ITEM 42).
8. INSERT LONGER PIN SIDE INTO ITEM 52. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 51 WHEN ASSEMBLED.

Schematic Diagram PN 412656-001H

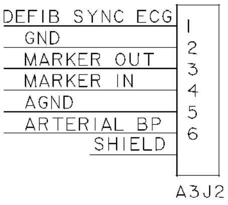
1 of 2


A9
DAS
ASSEMBLY
A9J2
A2J3
A5
PCB TRAM
FAN CONTROL BD
A5J1
A2J4
A3J1
A3
PCB TRAM
NON-ISO INPUT
A3J2
A3P1
A2J2
A2
PCB TRAM
A/SL CPU
A2J5
A1P1
A1
PCB TRAM3
POWER SUPPLY
A1J1
A2J1
W2P2
W2
A7
PCB TRAM
LED SPO2
A7J1
A3P2
W2P1
A4J1
A4
ASSY TRAM
SPO2 MODULE
A4J2
W1P2
P1
W1



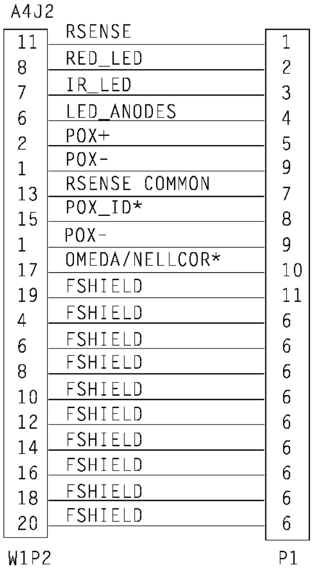
DLK TXD+	1
DLK TXD-	2
DLK RXD+	3
DLK RXD-	4
PWRRTN	5
SENSE OUT	6
+16 5V	7
PWRBUS	8
SHIELD	

A3J1



DEFIB SYNC ECG	1
GND	2
MARKER OUT	3
MARKER IN	4
AGND	5
ARTERIAL BP	6
SHIELD	

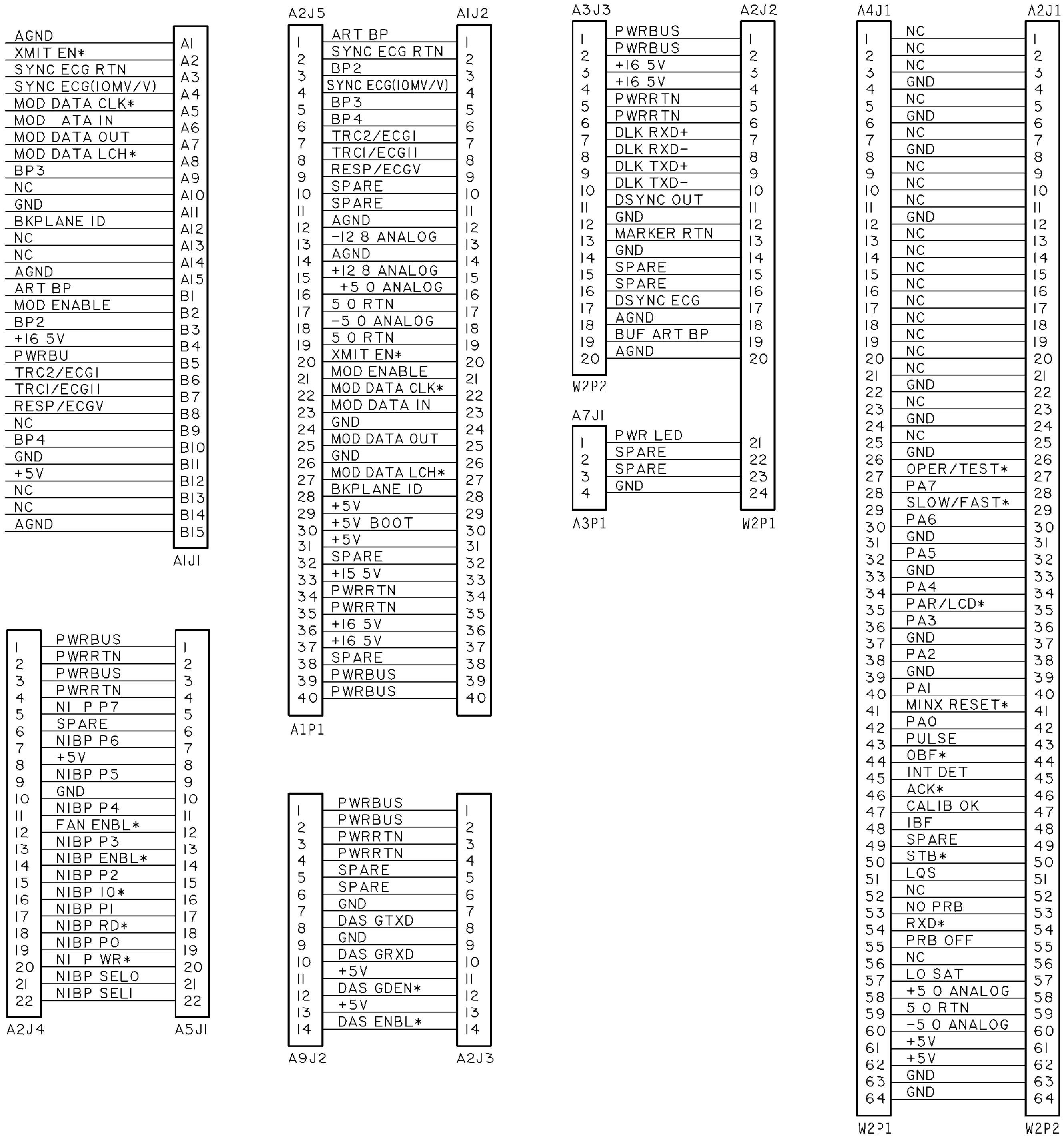
A3J2



A4J2

W1P2		P1
11	RSENSE	1
8	RED_LED	2
7	IR_LED	3
6	LED_ANODES	4
2	POX+	5
1	POX-	9
13	RSENSE COMMON	7
15	POX_ID*	8
1	POX-	9
17	OMEDA/NELLCOR*	10
19	FSHIELD	11
4	FSHIELD	6
6	FSHIELD	6
8	FSHIELD	6
10	FSHIELD	6
12	FSHIELD	6
14	FSHIELD	6
16	FSHIELD	6
18	FSHIELD	6
20	FSHIELD	6

2 of 2



	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD ATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBU	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J4		A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NI P P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP 10*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NI P WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A2J5		A1J2
1	ART BP	1
2	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	9
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
15	+12 8 ANALOG	15
16	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40
A1P1		

A9J2		A2J3
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A3J3		A2J2
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20
W2P2		
A7J1		
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24
A3P1		W2P1

A4J1		A2J1
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64
W2P1		W2P2

Parts List PN 412656-001H

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3	A1	Power Supply PCB	401309-002	1
4	A3	Non-Isolated Input PCB	401315-002	1
5		Shield, Top	401679-001	1
6		Shield, Bottom	401679-002	1
7		Latch	401682-001	2
8		Button, Latch	402106-001	2
9		Screw, Shoulder	402214-001	4
10		Spring, Compression	402315-001	2
11		Plate, Chassis Ground, Bottom/Front	402317-001	1
12		Pin, Latch	402806-001	2
13	A7	Power Indicator PCB	403170-011	1
14	A5	Fan PCB	403549-002	1
15		Spring, Chassis Ground, Rear	403741-001	AR
16		Screw, BDGH, Phillips, 4-40 x 7/8	404069-001	2
17		Insulator, Bottom Shield	404188-001	2
18		Carton, Shipping	404211-003	1
19		Foam, Insert	404211-004	1
20		Label, Blank	404525-006	1
21		Trim, Rubber, Front Bezel	404620-001	1
22		Mounting Strap, Trim	404621-001	1
23		Plate, Chassis Ground, Rear	404680-002	1
25		Spring, Latch	406019-001	2
26		Pin, Latch	406037-001	2
27		Bracket, Power Supply PCB	406254-001	1
28	W2	Connector, Header, Dual, 64-Pin	407452-002	1
29	A9	600 Acquisition Module, 10-Lead	417122-001	1
30		Front Bezel, Tram	412659-001	1
31		Label, Pulse Oximetry, Nellcor (Determined by Destination)	413831-002	1
32	A4	Pulse Oximetry Assembly (Including Pulse Oximetry PCB, PN 800674-00X)	414409-001	1
33		Screw, BDGH, Phillips, 4-40 x 3/16	4502-406	2
34		Screw, BDGH, Phillips, 4-40 x 1-1/4	4502-440	4
35		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
36		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	16
37		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
38		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
39		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
40		Nut, Hex, 4-40	4521-304	2

Item	Reference Designation	Parts List	Part Number	Qty
41		Adhesive, Diecut, Front Right	415098-001	1
42	A2	Module Processor PCB	800210-005	1
43	W1	Harness, Pulse Oximetry PCB-to-Connector	800892-001	1
44		Label, UL (Determined by Destination)	408230-002	1
45		Label, 60 Hertz	411091-018	1
45		Label, 50 Hertz	411091-019	1
46		Label, Top, English (Determined by Destination)	411175-009	1
46		Label, Top, German (Determined by Destination)	411175-010	1
46		Label, Top, French (Determined by Destination)	411175-011	1
46		Label, Top, Swedish (Determined by Destination)	411175-012	1
46		Label, Top, Spanish (Determined by Destination)	411175-013	1
46		Label, Top, Italian (Determined by Destination)	411175-014	1
46		Label, Top, Dutch (Determined by Destination)	411175-015	1
47		Label, Front, 650SL, English (Determined by Destination)	413840-001	1
47		Label, Front, 650SL, German (Determined by Destination)	413840-002	1
47		Label, Front, 650SL, French (Determined by Destination)	413840-003	1
47		Label, Front, 650SL, Swedish (Determined by Destination)	413840-004	1
47		Label, Front, 650SL, Spanish (Determined by Destination)	413840-005	1
47		Label, Front, 650SL, Italian (Determined by Destination)	413840-006	1
47		Label, Front, 650SL, Dutch (Determined by Destination)	413840-007	1
48		Label, Cover, English (Determined by Destination)	414050-001	1
48		Label, Cover, German (Determined by Destination)	414050-002	1
48		Label, Cover, French (Determined by Destination)	414050-003	1
48		Label, Cover, Swedish (Determined by Destination)	414050-004	1
48		Label, Cover, Spanish (Determined by Destination)	414050-005	1
48		Label, Cover, Italian (Determined by Destination)	414050-006	1
48		Label, Cover, International (Determined by Destination)	414050-007	1
49		Scew, PHD, 4-40 x 0.188, Modified (Determined by Destination)	409009-001	1
49		Scew, PHD, 4-40 x 0.188, Determined by Destination)	45074-406	1
50		Adhesive, Diecut, Front Left	415098-002	1
51		Tram 100 - 850 A & SL Module Service Manaul	404422-065	1
52		Label, CE Mark	408230-008	1
53		PC Post, 2 x 7	412062-004	1
54		PC Post, 2 x 11	412062-005	1
55		Spring, Chassis Ground, Small	414610-001	AR

Assembly Revisions PN 412656

The baseline revision for this assembly is pn 412656-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 412656-001A

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
41		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
42		Module Processor PCB	800210-002	800210-005	1
49		Spring, Chassis Ground, Small	Not Used	414610-001	AR
50		Adhesive, Diecut Front Left	Not Used	415098-002	1
52		Label, CE Mark	Not Used	408230-008	1
53		PC Post, 2 x 7	Not Used	412062-004	1
54		PC Post, 2 x 11	Not Used	412062-005	1

PN 412656-001B

This revision was a documentation change that does not affect this manual.
Refer to pn 412656-001A for changes to the parts list.

PN 412656-001C

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
42		Module Processor PCB	800210-002	800210-005	1
52		Label, CE Mark	Not Used	408230-008	1
53		PC Post, 2 x 7	Not Used	412062-004	1
54		PC Post, 2 x 11	Not Used	412062-005	1

PN 412656-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 412656-001C for changes to the parts list.

PN 412656-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 412656-001C for changes to the parts list.

PN 412656-001F

This revision was a documentation change that does not affect this manual.
Refer to pn 412656-001C for changes to the parts list.

PN 412656-001G

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
29	A9	DAS 600 Module, 10-Lead	411168-001	417122-001	1

15

TRAM 800A/SL MODULE PN 411080/411024

General **15-2**
Circuit Boards 15-2

Exploded View PN 411080-001J **15-3**

Schematic Diagram PN 411080-001J **15-5**

Parts List PN 411080-001J **15-7**

Assembly Revisions PN411080 .... **15-10**

Exploded View PN 411024-001J **15-12**

Schematic Diagram PN 411024-001J **15-14**

Parts List PN 411024-001J **15-16**

Assembly Revisions PN 411024 .... **15-19**

General

Circuit Boards

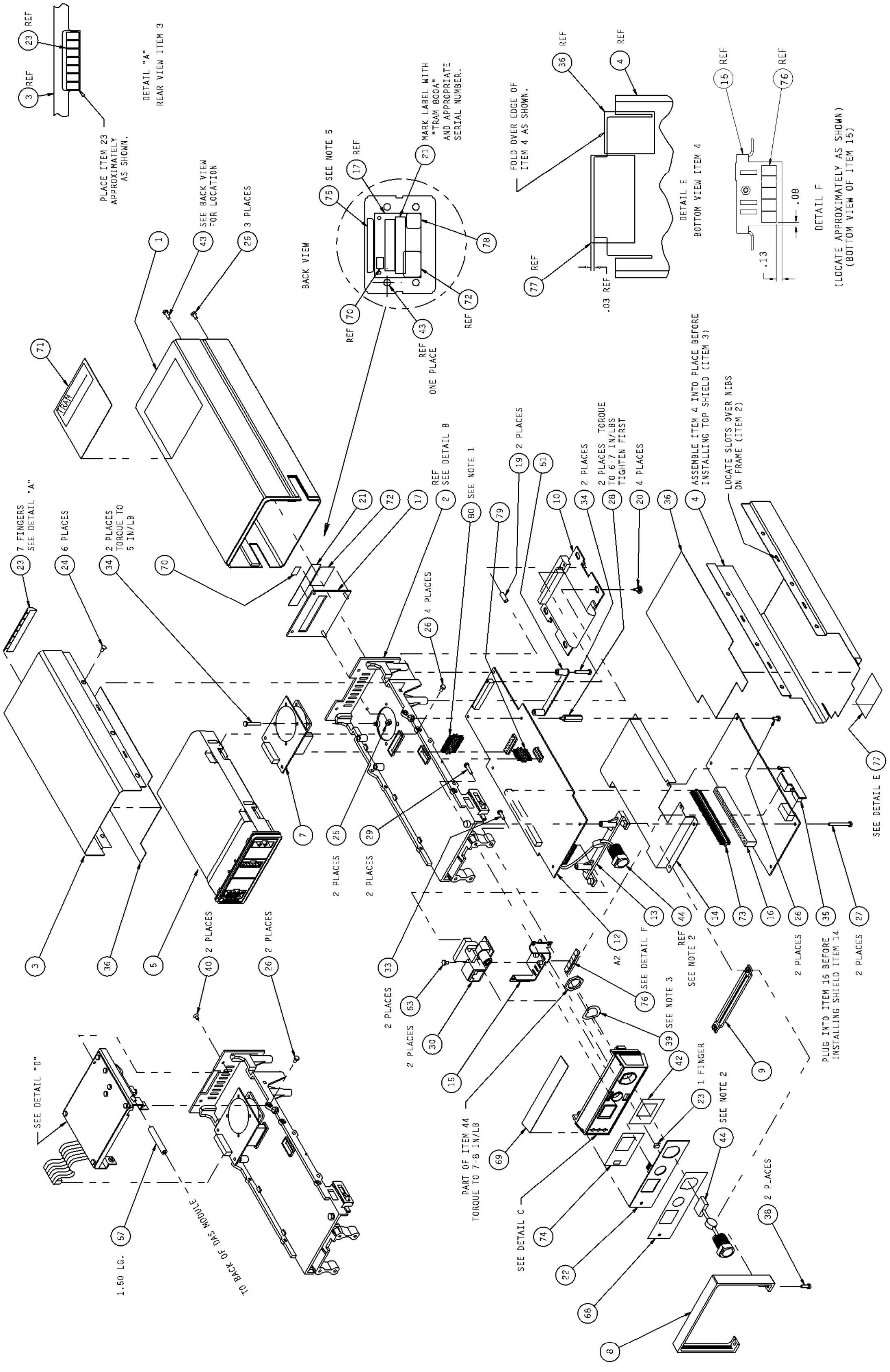
Details about the circuit boards contained in the Tram 800A/SL are discussed in later chapters arranged by part number.

Table 15-1. Circuit Board Overview

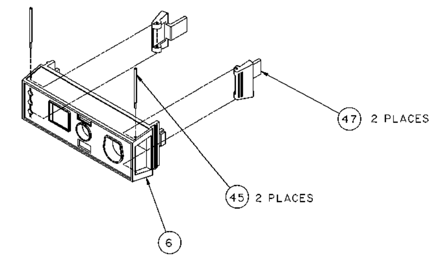
Module Type	Upper Level	Leadwire Configuration	DAS Module	Acquisition Processor PCB	Module Processor PCB
Tram 800A	411080-001A–H	5-Leadwire	411068-001	800330-011	800210-005
Tram 800A	411080-001J	5-Leadwire	417124-001 (Replaced 411068-001)	801040-002	800210-005
Tram 800SL	411024-001A–H	10-Leadwire	411025-001	800330-012	800210-005
Tram 800SL	411024-001J	10-Leadwire	417123-001 (Replaced 411025-001)	801040-001	800210-005

Exploded View PN 411080-001J

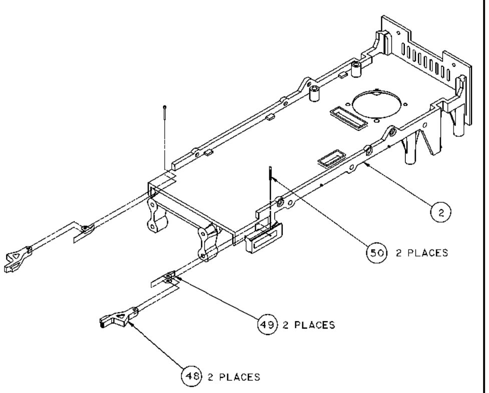
1 of 2


23 REF
3 REF
DETAIL "A"
REAR VIEW ITEM 3
PLACE ITEM 23 APPROXIMATELY AS SHOWN.
SEE BACK VIEW FOR LOCATION
3 PLACES
BACK VIEW
75 SEE NOTE 5
17 REF
21 MARK LABEL WITH "TRAM 800A" AND APPROPRIATE SERIAL NUMBER.
78
70 REF
43 REF ONE PLACE
72 REF
FOLD OVER EDGE OF ITEM 4 AS SHOWN.
36 REF
4 REF
77 REF
.03 REF
DETAIL E
BOTTOM VIEW ITEM 4
15 REF
76 REF
.08
.13
DETAIL F
(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 15)
1
43
26
71
TRAM
23 7 FINGERS SEE DETAIL "A"
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
70
21
72
17
2 REF SEE DETAIL B
80 SEE NOTE 1
79
19 2 PLACES
51
10
34 2 PLACES
28 2 PLACES TORQUE TO 6-7 IN/LBS TIGHTEN FIRST
20 4 PLACES
36
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
26 4 PLACES
7
25 2 PLACES
29 2 PLACES
77 SEE DETAIL E
3
36
5
40 2 PLACES
26 2 PLACES
33
A2 12
13
44 REF SEE NOTE 2
14
73
16
26 2 PLACES
35 PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
27 2 PLACES
63 2 PLACES
30 2 PLACES
76 SEE DETAIL F
39 SEE NOTE 3
9
15 PART OF ITEM 44 TORQUE TO 7-8 IN/LB
42
23 1 FINGER
44 SEE NOTE 2
SEE DETAIL "D"
57 1.50 LG.
TO BACK OF DAS MODULE
69
SEE DETAIL C
74
22
68
38 2 PLACES
8

2 of 2

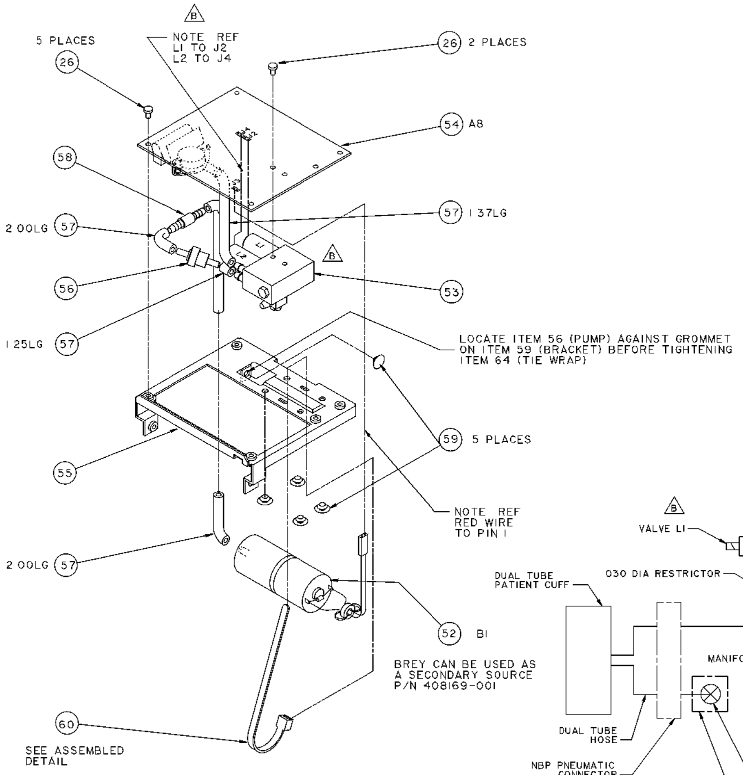

47 2 PLACES
45 2 PLACES
6

DETAIL C


2
50 2 PLACES
49 2 PLACES
48 2 PLACES

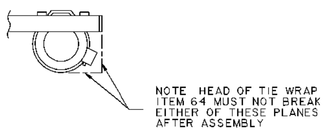
DETAIL B

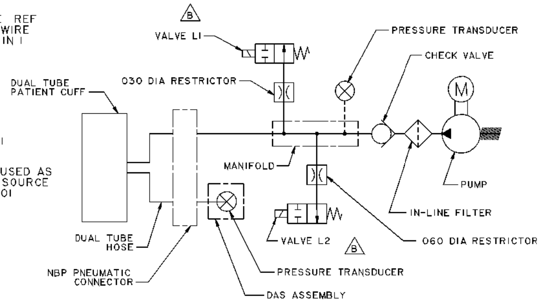
NOTES;
1. INSERT LONGER PIN SIDE INTO ITEM 12. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 12 WHEN ASSEMBLED.
1. PULSE OXIMETRY CABLE ITEM 44 TO BE ROUTED TO THE INSIDE OF FIRST STANDOFF ON ITEM 13, THEN BEHIND NON-ISO INPUT PCB (ITEM 30) FLEX CIRCUIT CONNECTOR AND LASTLY TO THE INSIDE OF SECOND STANDOFF ON ITEM 13.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. SWITCH SETTING MUST BE MADE FOR EACH CONFIGURATION. SEE PRODUCT LEVEL NOTE. (REFER TO SWITCH CHART)
5. MARK LABEL ITEM 75, AS FOLLOWS: ZULASSUNGSKENNZEICHEN: 01/M-305/94.
6. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
7.
8. SHIP ITEM 67 WITH EACH UNIT.
9. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.


B
5 PLACES
26
NOTE REF
L1 TO J2
L2 TO J4
26 2 PLACES
54 A8
58
57 1 37LG
2 00LG 57
B
56
53
1 25LG 57
LOCATE ITEM 56 (PUMP) AGAINST GROMMET ON ITEM 59 (BRACKET) BEFORE TIGHTENING ITEM 64 (TIE WRAP)
59 5 PLACES
55
NOTE REF RED WIRE TO PIN 1
2 00LG 57
52 B1
BREY CAN BE USED AS A SECONDARY SOURCE P/N 408169-001
60
SEE ASSEMBLED DETAIL

DETAIL D

ASSEMBLED DETAIL

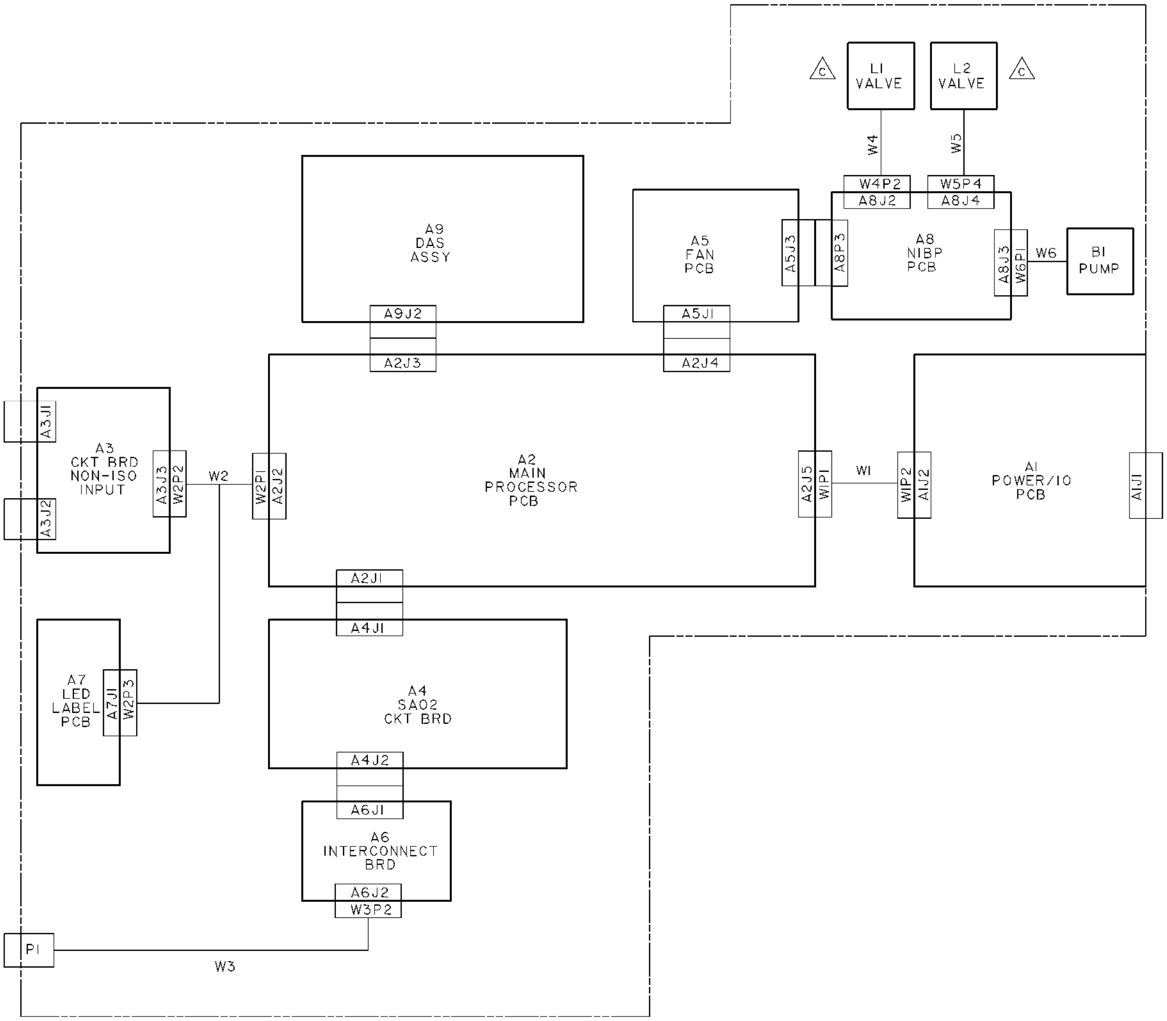

NOTE HEAD OF TIE WRAP ITEM 64 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY

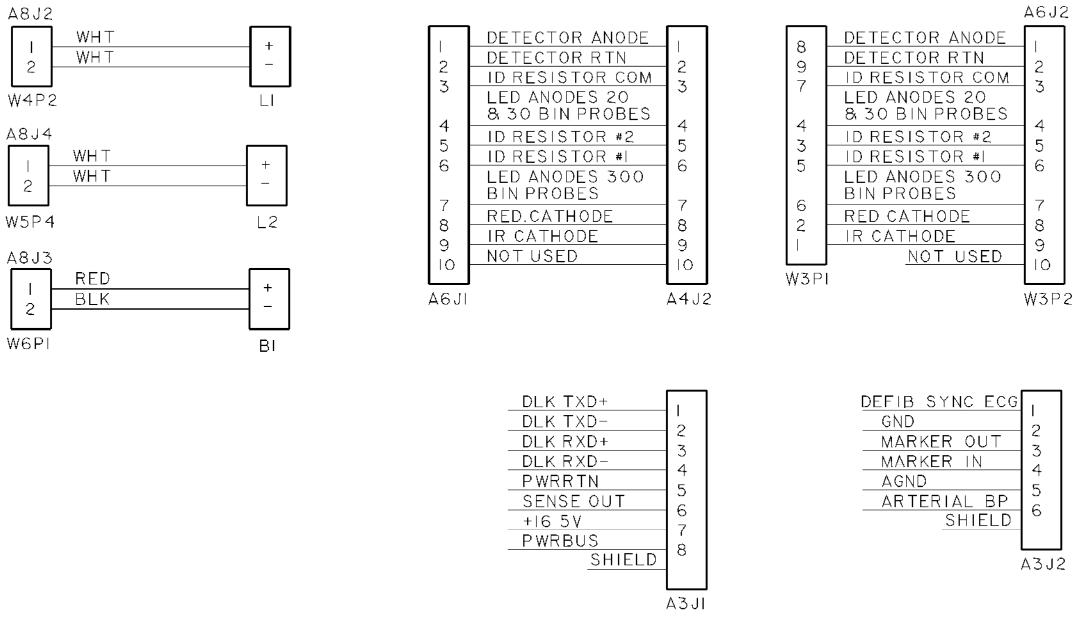

B
VALVE L1
PRESSURE TRANSDUCER
CHECK VALVE
M
030 DIA RESTRICTOR
DUAL TUBE PATIENT CUFF
MANIFOLD
PUMP
IN-LINE FILTER
060 DIA RESTRICTOR
VALVE L2
B
DUAL TUBE HOSE
NBP PNEUMATIC CONNECTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY

PNEUMATIC SCHEMATIC

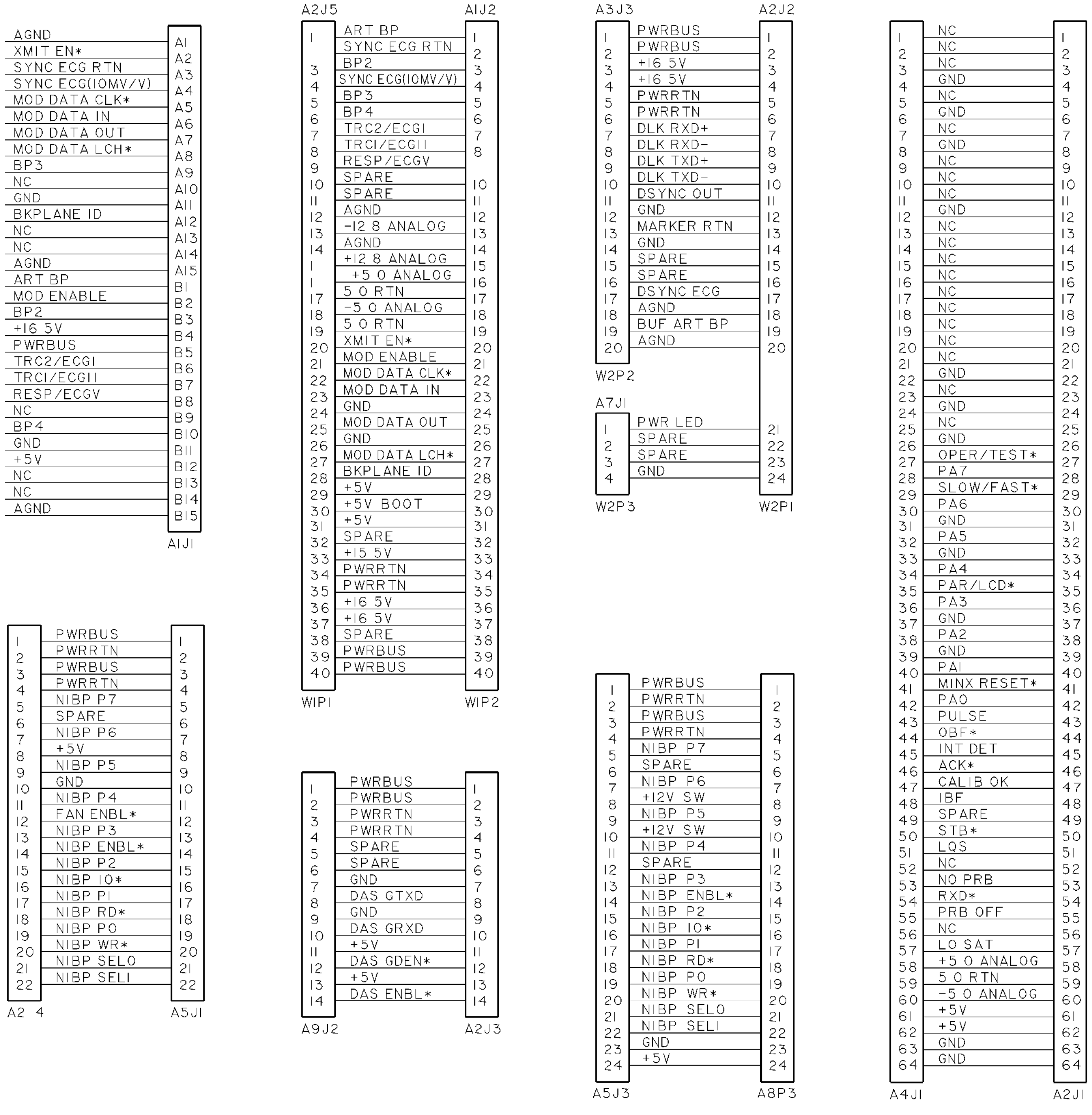
Schematic Diagram PN 411080-001J

1 of 2


L1 VALVE
L2 VALVE
C
C
W4
W5
W4P2
A8J2
W5P4
A8J4
A9 DAS ASSY
A9J2
A2J3
A5 FAN PCB
A5J3
A8P3
A5J1
A2J4
A8 NIBP PCB
A8J3
W6P1
W6
B1 PUMP
A3J1
A3 CKT BRD NON-ISO INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2 MAIN PROCESSOR PCB
A2J5
W1P1
W1
W1P2
A1J2
A1 POWER/IO PCB
A1J1
A3J2
A2J1
A4J1
A7 LED LABEL PCB
A7J1
W2P3
A4 SA02 CKT BRD
A4J2
A6J1
A6 INTERCONNECT BRD
A6J2
W3P2
P1
W3


A8J2
1
2
WHT
WHT
+
−
W4P2
L1
A8J4
1
2
WHT
WHT
+
−
W5P4
L2
A8J3
1
2
RED
BLK
+
−
W6P1
B1
A6J1
1 DETECTOR ANODE 1
2 DETECTOR RTN 2
3 ID RESISTOR COM 3
4 LED ANODES 20 & 30 BIN PROBES 4
5 ID RESISTOR #2 5
6 ID RESISTOR #1 6
7 LED ANODES 300 BIN PROBES 7
8 RED.CATHODE 8
9 IR CATHODE 9
10 NOT USED 10
A4J2
W3P1
8 DETECTOR ANODE 1
9 DETECTOR RTN 2
7 ID RESISTOR COM 3
4 LED ANODES 20 & 30 BIN PROBES 4
3 ID RESISTOR #2 5
5 ID RESISTOR #1 6
6 LED ANODES 300 BIN PROBES 7
2 RED CATHODE 8
1 IR CATHODE 9
NOT USED 10
A6J2
W3P2
DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16.5V 7
PWRBUS 8
SHIELD
A3J1
DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2

2 of 2



AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD DATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBUS	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15
	A1J1

A2J5		A1J2
1	ART BP	1
	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
1	+12 8 ANALOG	15
1	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40
W1P1		W1P2

A3J3		A2J2
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20
W2P2		
A7J1		
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24
W2P3		W2P1

1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64
A4J1		A2J1

1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP 10*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
A2 4		A5J1

1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14
A9J2		A2J3

1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+12V SW	8
9	NIBP P5	9
10	+12V SW	10
11	NIBP P4	11
12	SPARE	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP 10*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
23	GND	23
24	+5V	24
A5J3		A8P3

Parts List PN 411080-001J

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3		Shield, Top	401679-001	1
4		Shield, Bottom	401679-002	1
5	A9	800 Acquisition Module, 5-Lead	417124-001	1
6		Front Bezel, Lower	401105-004	1
7	A5	Fan PCB	403549-002	1
8		Trim, Rubber, Front Bezel	404620-001	1
9		Mounting Strap, Trim	404621-001	1
10	A1	Power Supply PCB	401309-002	1
12	A2	Module Processor PCB	800210-005	1
13		Circuit Board/Bezel Mount	404762-001	1
14		Shield, Pulse Oximetry PCB	401680-001	1
15		Plate, Chassis Ground, Bottom/Front	402317-001	1
16	A4	Pulse Oximetry PCB	401189-001	1
17		Plate, Chassis Ground, Rear	404680-002	1
19		Spring, Compression	402315-001	2
20		Screw, Power Supply PCB Mounting, SST, 4-40	402214-001	4
21		Label, Model/Serial Number	404525-006	1
22	A7	Power Indicator PCB	403170-008	1
23		Spring, Chassis Ground, Rear	403741-001	AR
24		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
25		Nut, Hex, 4-40	4521-304	2
26		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	18
27		Screw, BDGH, Phillips, 4-40 x 1-3/8	45074-438	2
28		Spacer, Male/Female, 4-40 x 0.875	4656-414	2
29		Screw, 4-40 x 7/8	404069-001	2
30	A3	Non-Isolated Input PCB	401315-002	1
31		Carton, Shipping	404211-003	1
32		Foam Insert	404211-004	2
33		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
34		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
35	A6	Interconnect PCB	800006-001	1
36		Insulator, Bottom Shield	404188-001	2
38		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
39		Washer, Pulse Oximetry Connector	4550-250	1
40		Screw, FLH, Phillips, SST, 4-40 x 3/8	4505-412	2
41		Tram 100 - 850 A and SL Modules Service Manual	404422-065	1
42		Adhesive, Diecut, Front Right	415098-001	1
43		Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination)	409009-001	1

Item	Reference Designation	Parts List	Part Number	Qty
43		Screw, PHD, 4-40 x 0.188, (Determined by Destination)	45074-406	1
44	W3	Harness Assembly, SpO2 – w/Choke	700091-004	1
45		Pin, Latch	402806-001	2
46		Spring, Flat, SST	405041-001	2
47		Button, Latch	402106-001	1
48		Latch	401682-001	1
49		Spring, Latch	406019-001	2
50		Pin, Latch	406037-001	2
51		Bracket, Power Supply PCB	406254-001	1
52	B1	Pump Assembly, NBP, w/Harness	408169-002	1
53	A10	NBP Valve Assembly	416153-001	1
54	A8	NBP PCB	800316-002	1
55		Bracket, NBP Mounting	404296-001	1
56		Check Valve, 0.125 ID	404675-001	1
57		Tubing, Silastic	401582-001	AR
58		Filter, 43 Micron	404679-001	1
59		Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness	404749-001	5
60		Tie Wrap	4535-002	1
63		Screw, PNH, Phillips, SST, 4-40 x 3/16	4502-406	2
67		SpO2 Sensor, Adult, Finger, Package of 6	411667-001	1
68		Label, Front, 800SL, English (Determined by Destination)	411043-002	1
68		Label, Front, 800A, German (Determined by Destination)	411043-003	1
68		Label, Front, 800A, French (Determined by Destination)	411043-004	1
68		Label, Front, 800A, Swedish (Determined by Destination)	411043-005	1
68		Label, Front, 800A, Spanish (Determined by Destination)	411043-006	1
68		Label, Front, 800A, Italian (Determined by Destination)	411043-007	1
68		Label, Front, 800A, Dutch (Determined by Destination)	411043-008	1
69		Label, Top, English (Determined by Destination)	411091-009	1
69		Label, Top, German (Determined by Destination)	411091-010	1
69		Label, Top, French (Determined by Destination)	411091-011	1
69		Label, Top, Swedish (Determined by Destination)	411091-012	1
69		Label, Top, Spanish (Determined by Destination)	411091-013	1
69		Label, Top, Italian (Determined by Destination)	411091-014	1
69		Label, Top, Dutch (Determined by Destination)	411091-015	1
70		Label, 60 Hertz (Determined by Destination)	411091-018	1
70		Label, 50 Hertz (Determined by Destination)	411091-019	1
71		Label, Cover, English (Determined by Destination)	411043-016	1

Item	Reference Designation	Parts List	Part Number	Qty
71		Label, Cover, German (Determined by Destination)	411043-020	1
71		Label, Cover, French (Determined by Destination)	411043-021	1
71		Label, Cover, Swedish (Determined by Destination)	411043-022	1
71		Label, Cover, Spanish (Determined by Destination)	411043-023	1
71		Label, Cover, Italian (Determined by Destination)	411043-024	1
71		Label, Cover, International (Determined by Destination)	411043-025	1
72		Label, TUV (Determined by Destination)	408103-003	1
72		Label, UL Listed (Determined by Destination)	408230-002	1
73	P1	Connector, Header, 64-Pin, w/Ferrites	409203-001	1
74		Adhesive, Diecut, Front Left	415098-002	1
76		Spring, Chassis Ground, Small	414610-001	AR
77		Adhesive, Mylar	415316-001	1
78		Label, CE Mark	408230-008	1
79		PC Post, 2 x 7	412062-004	1
80		PC Post, 2 x 11	412062-005	1

Assembly Revisions PN 411080

The baseline revision for this assembly is pn 411080-001J. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 411080-001C

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 800A Module, 10-Lead	411068-001	417124-001	1
11		Label Set, Tram 800A	411043-001	Not Used	1
12		Module Processor PCB	800210-002	800210-005	1
42		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
53	A6	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1
63		Screw, Phillips, STT, 4-40 x 3/16	Not Used	4502-406	2
73		Connector, Header 64-pin w/Ferrites	Not Used	409203-001	1
74		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411080-001D

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 800A Module, 10-Lead	411068-001	417124-001	1
12		Module Processor PCB	800210-002	800210-005	1
42		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
53	A6	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1
74		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411080-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 411080-001D for changes to the parts list.

PN 411080-001F

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 800A Module, 10-Lead	411068-001	417124-001	1
12		Module Processor PCB	800210-002	800210-005	1
53	A6	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411080-001G

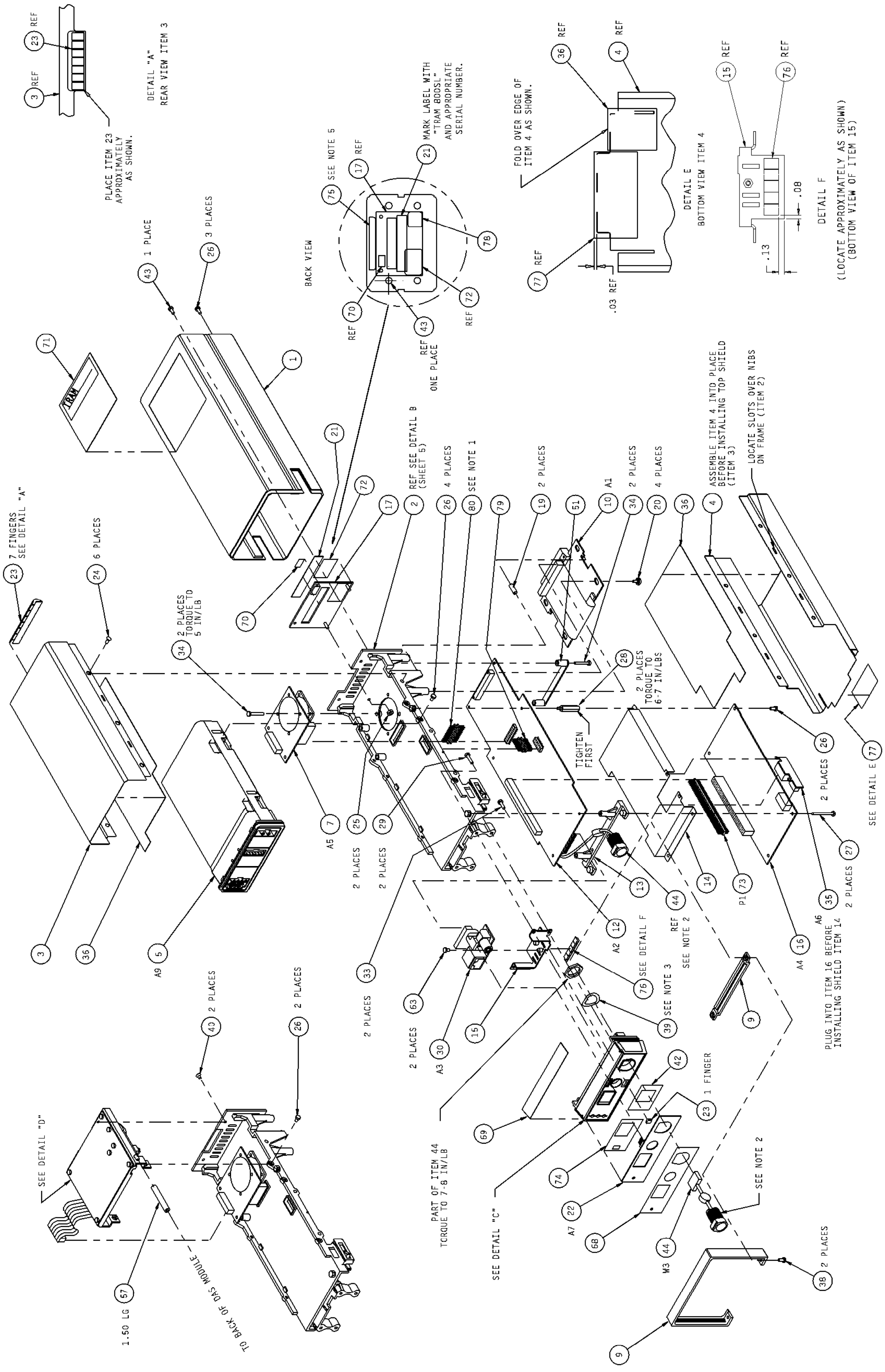
This revision was a documentation change that does not affect this manual.
Refer to pn 411080-001F for changes to the parts list.

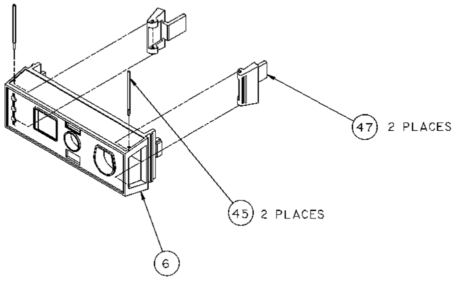
PN 411080-001H

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 800A Module, 10-Lead	411068-001	417124-001	1
53	A6	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1

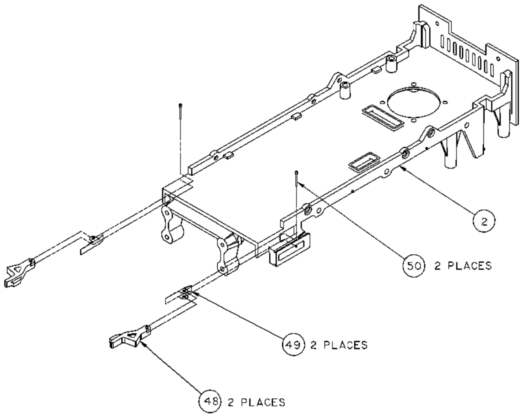
Exploded View PN 411024-001J

1 of 2


DETAIL "A"
REAR VIEW ITEM 3
3 REF
23 REF
PLACE ITEM 23 APPROXIMATELY AS SHOWN.
BACK VIEW
SEE NOTE 5
75
17 REF
21
MARK LABEL WITH "TRAM 800SL" AND APPROPRIATE SERIAL NUMBER.
78
72 REF
43 REF ONE PLACE
70 REF
FOLD OVER EDGE OF ITEM 4 AS SHOWN.
36 REF
4 REF
77 REF
.03 REF
DETAIL E
BOTTOM VIEW ITEM 4
15 REF
76 REF
.13
.08
DETAIL F
(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 15)
43 1 PLACE
26 3 PLACES
71
TRAM
1
21
72
70
17
2 REF SEE DETAIL B (SHEET 5)
26 4 PLACES
80 SEE NOTE 1
79
19 2 PLACES
51
10 A1
34 2 PLACES
20 4 PLACES
36
4 ASSEMBLE ITEM 4 INTO PLACE BEFORE INSTALLING TOP SHIELD (ITEM 3)
LOCATE SLOTS OVER NIBS ON FRAME (ITEM 2)
23 7 FINGERS SEE DETAIL "A"
24 6 PLACES
34 2 PLACES TORQUE TO 5 IN/LB
28 2 PLACES TORQUE TO 6-7 IN/LBS
TIGHTEN FIRST
26
77 SEE DETAIL E
2 PLACES
27
3
36
A9 5
A5 7
25 2 PLACES
29 2 PLACES
33
13
44
14
P1 73
A2 12
REF SEE NOTE 2
76 SEE DETAIL F
A6 35 2 PLACES
A4 16 PLUG INTO ITEM 16 BEFORE INSTALLING SHIELD ITEM 14
9
63 2 PLACES
A3 30 2 PLACES
15
39 SEE NOTE 3
42
23 1 FINGER
69
74
A7 22
68
W3 44
SEE NOTE 2
38 2 PLACES
9
PART OF ITEM 44 TORQUE TO 7-8 IN/LB
SEE DETAIL "C"
40 2 PLACES
26 2 PLACES
SEE DETAIL "D"
57 1.50 LG
TO BACK OF DAS MODULE

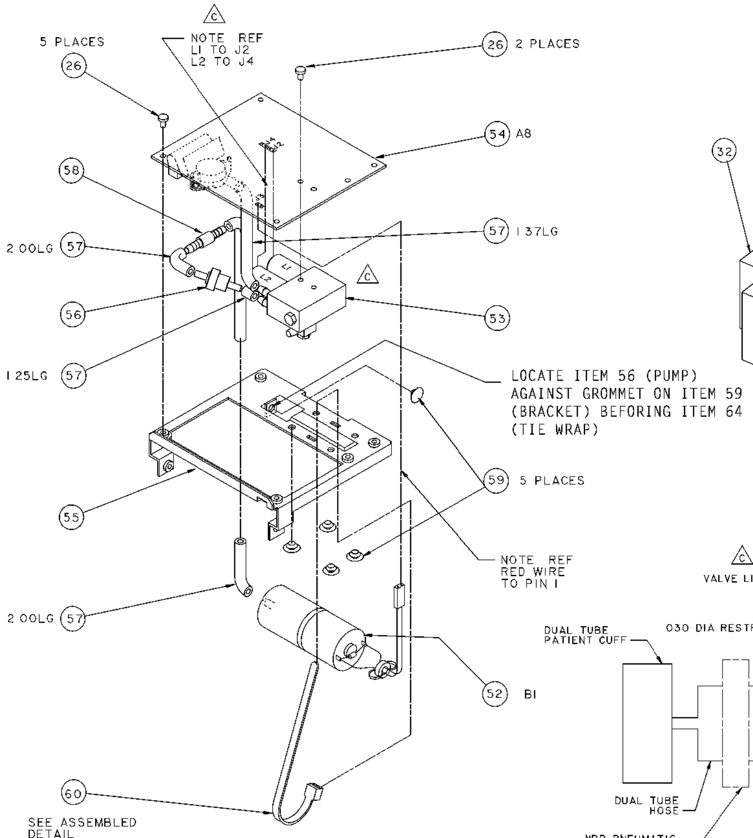

47 2 PLACES
45 2 PLACES
6

DETAIL C


2
50 2 PLACES
49 2 PLACES
48 2 PLACES

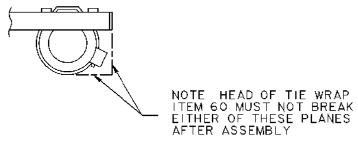
DETAIL B

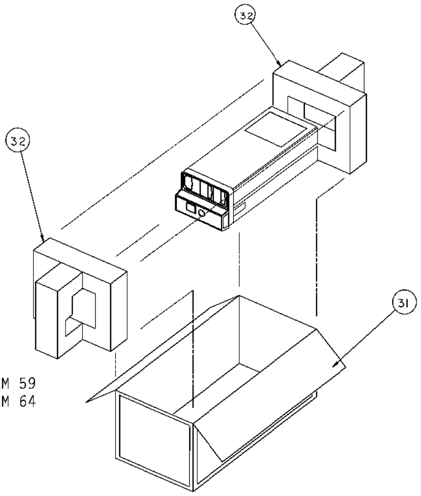
NOTES;
1. INSERT LONGER PIN SIDE INTO ITEM 12. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 12 WHEN ASSEMBLED.
1. PULSE OXIMETRY CABLE ITEM 44 TO BE ROUTED TO THE INSIDE OF FIRST STANDOFF ON ITEM 13, THEN BEHIND NON-ISO INPUT PCB (ITEM 30) FLEX CIRCUIT CONNECTOR AND LASTLY TO THE INSIDE OF SECOND STANDOFF ON ITEM 13.
3. CURVED WASHER MUST BE INSTALLED CONCAVE SIDE OUT.
4. SWITCH SETTING MUST BE MADE FOR EACH CONFIGURATION. SEE PRODUCT LEVEL NOTE. (REFER TO SWITCH CHART)
5. MARK LABEL ITEM 75, AS FOLLOWS:
   ZULASSUNGSKENNZEICHEN: 01/M-305/94.
6. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
7. SHIP ITEM 67 (OXY TIP SIX PACK) WITH EACH UNIT.
8. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.

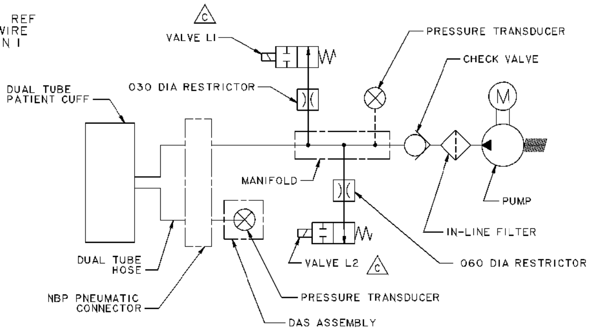

C
5 PLACES
26
NOTE REF
LI TO J2
L2 TO J4
26 2 PLACES
54 A8
58
2 00LG 57
57 1 37LG
C
56
53
1 25LG 57
LOCATE ITEM 56 (PUMP)
AGAINST GROMMET ON ITEM 59
(BRACKET) BEFORING ITEM 64
(TIE WRAP)
59 5 PLACES
55
NOTE REF
RED WIRE
TO PIN I
2 00LG 57
52 BI
60
SEE ASSEMBLED
DETAIL

DETAIL D

ASSEMBLED DETAIL


NOTE HEAD OF TIE WRAP
ITEM 60 MUST NOT BREAK
EITHER OF THESE PLANES
AFTER ASSEMBLY

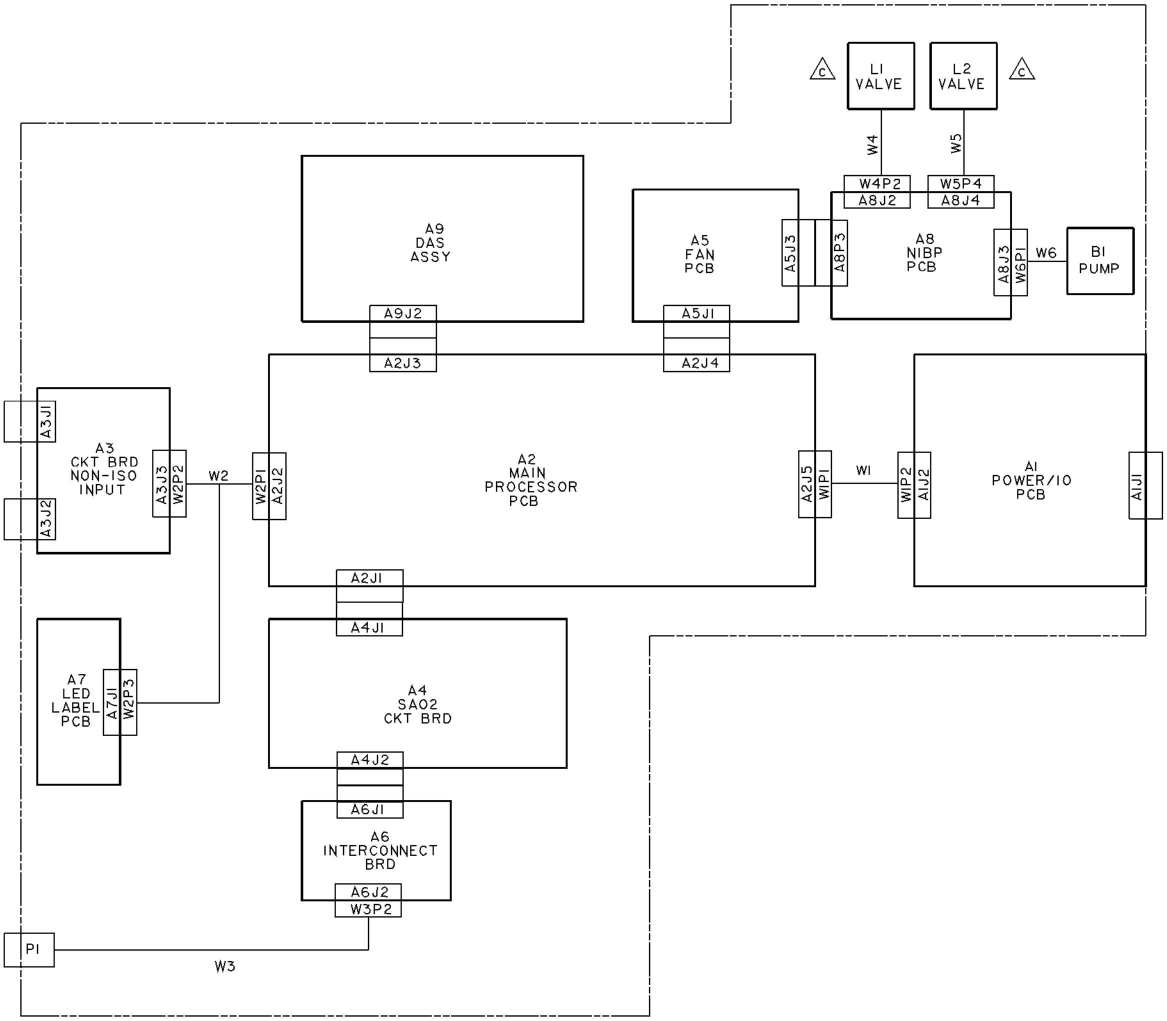


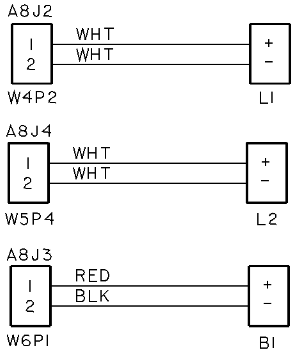

C
VALVE LI
PRESSURE TRANSDUCER
CHECK VALVE
M
DUAL TUBE
PATIENT CUFF
030 DIA RESTRICTOR
MANIFOLD
PUMP
IN-LINE FILTER
DUAL TUBE
HOSE
VALVE L2
C
060 DIA RESTRICTOR
NBP PNEUMATIC
CONNECTOR
PRESSURE TRANSDUCER
DAS ASSEMBLY

PNEUMATIC SCHEMATIC

Schematic Diagram PN 411024-001J

1 of 2


C
L1 VALVE
L2 VALVE
C
W4
W5
W4P2
A8J2
W5P4
A8J4
A9 DAS ASSY
A5 FAN PCB
A5J3
A8P3
A8 NIBP PCB
A8J3
W6P1
W6
B1 PUMP
A9J2
A2J3
A5J1
A2J4
A3J1
A3 CKT BRD NON-ISO INPUT
A3J3
W2P2
W2
W2P1
A2J2
A2 MAIN PROCESSOR PCB
A2J5
W1P1
W1
W1P2
A1J2
A1 POWER/IO PCB
A1J1
A3J2
A2J1
A4J1
A7 LED LABEL PCB
A7J1
W2P3
A4 SA02 CKT BRD
A4J2
A6J1
A6 INTERCONNECT BRD
A6J2
W3P2
P1
W3


A8J2
1
2
WHT
WHT
+
−
W4P2
L1
A8J4
1
2
WHT
WHT
+
−
W5P4
L2
A8J3
1
2
RED
BLK
+
−
W6P1
B1

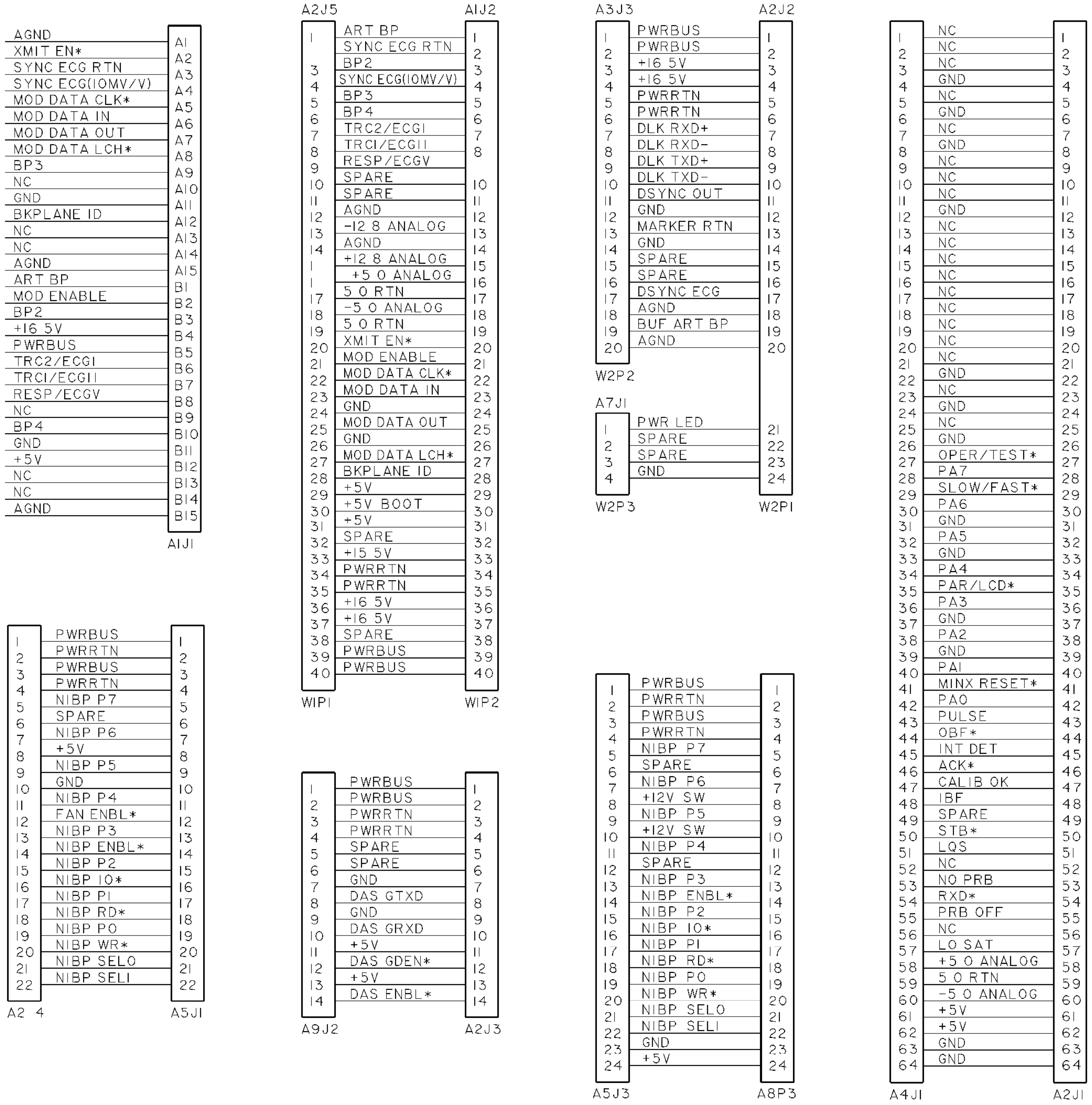
A6J1		A4J2
1	DETECTOR ANODE	1
2	DETECTOR RTN	2
3	ID RESISTOR COM	3
4	LED ANODES 20 & 30 BIN PROBES	4
5	ID RESISTOR #2	5
6	ID RESISTOR #1	6
7	LED ANODES 300 BIN PROBES	7
8	RED.CATHODE	8
9	IR CATHODE	9
10	NOT USED	10

W3P1		A6J2 / W3P2
8	DETECTOR ANODE	1
9	DETECTOR RTN	2
7	ID RESISTOR COM	3
4	LED ANODES 20 & 30 BIN PROBES	4
3	ID RESISTOR #2	5
5	ID RESISTOR #1	6
6	LED ANODES 300 BIN PROBES	7
2	RED CATHODE	8
1	IR CATHODE	9
	NOT USED	10

	A3J1
DLK TXD+	1
DLK TXD−	2
DLK RXD+	3
DLK RXD−	4
PWRRTN	5
SENSE OUT	6
+16.5V	7
PWRBUS	8
SHIELD	

	A3J2
DEFIB SYNC ECG	1
GND	2
MARKER OUT	3
MARKER IN	4
AGND	5
ARTERIAL BP	6
SHIELD	

2 of 2



AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD DATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBUS	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15
	A1J1

1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
A2 4		A5J1

A2J5		A1J2
1	ART BP	1
	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
1	+12 8 ANALOG	15
1	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40
W1P1		W1P2

1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14
A9J2		A2J3

A3J3		A2J2
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20
W2P2		
A7J1		
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24
W2P3		W2P1

1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+12V SW	8
9	NIBP P5	9
10	+12V SW	10
11	NIBP P4	11
12	SPARE	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
23	GND	23
24	+5V	24
A5J3		A8P3

1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64
A4J1		A2J1

Parts List PN 411024-001J

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3		Shield, Top	401679-001	1
4		Shield, Bottom	401679-002	1
5	A9	800 Acquisition Module, 10-Lead	417123-001	1
6		Front Bezel, Lower	401105-004	1
7	A5	Fan PCB	403549-002	1
8		Trim, Rubber, Front Bezel	404620-001	1
9		Mounting Strap, Trim	404621-001	1
10	A1	Power Supply PCB	401309-002	1
12	A2	Module Processor PCB	800210-005	1
13		Circuit Board/Bezel Mount	404762-001	1
14		Shield, Pulse Oximetry PCB	401680-001	1
15		Plate, Chassis Ground, Bottom/Front	402317-001	1
16	A4	Pulse Oximetry PCB	401189-001	1
17		Plate, Chassis Ground, Rear	404680-002	1
19		Spring, Compression	402315-001	2
20		Screw, Power Supply PCB Mounting, SST, 4-40	402214-001	4
21		Label, Model/Serial Number	404525-006	1
22	A7	Power Indicator PCB	403170-008	1
23		Spring, Chassis Ground, Rear	403741-001	AR
24		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
25		Nut, Hex, 4-40	4521-304	2
26		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	17
27		Screw, BDGH, Phillips, 4-40 x 1-3/8	45074-438	2
28		Spacer, Male/Female, 4-40 x 0.875	4656-414	2
29		Screw, 4-40 x 7/8	404069-001	2
30	A3	Non-Isolated Input PCB	401315-002	1
31		Carton, Shipping	404211-003	1
32		Foam Insert	404211-004	2
33		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
34		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
35	A6	Interconnect PCB	800006-001	1
36		Insulator, Bottom Shield	404188-001	2
38		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
39		Washer, Pulse Oximetry Connector	4550-250	1
40		Screw, FLH, Phillips, SST, 4-40 x 3/8	4505-412	2
41		Tram 100 - 850 A and SL Modules Service Manual	404422-065	AR
42		Adhesive, Diecut, Front Right	415098-010	1

Item	Reference Designation	Parts List	Part Number	Qty
43		Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination)	409009-001	1
43		Screw, PHD, 4-40 x 0.188, (Determined by Destination)	45074-406	1
44		Harness Assembly, SpO2 – w/Choke	700091-004	1
45		Pin, Latch	402806-001	0
47		Button, Latch	402106-001	2
48		Latch	401682-001	2
49		Spring, Latch	406019-001	2
50		Pin, Latch	406037-001	2
51		Bracket, Power Supply PCB	406254-001	1
52	B1	Pump Assembly, NBP, w/Harness	408169-002	1
53	A10	NBP Valve Assembly	416153-001	1
54	A8	NBP PCB	800316-002	1
55		Bracket, NBP Mounting	404296-001	1
56		Check Valve, 0.125 ID	404675-001	1
57		Tubing, Silastic	401582-001	AR
58		Filter, 43 Micron	404679-001	1
59		Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness	404749-001	5
60		Tie Wrap	4535-002	1
63		Screw, PNH, Phillips, SST, 4-40 x 3/16	4502-406	2
67		SpO2 Sensor, Adult, Finger, Package of 6	411667-001	1
68		Label, Front, 800SL, English (Determined by Destination)	411091-002	1
68		Label, Front, 800SL, German (Determined by Destination)	411091-003	1
68		Label, Front, 800SL, French (Determined by Destination)	411091-004	1
68		Label, Front, 800SL Swedish (Determined by Destination)	411091-005	1
68		Label, Front, 800SL, Spanish (Determined by Destination)	411091-006	1
68		Label, Front, 800SL, Italian (Determined by Destination)	411091-007	1
68		Label, Front, 800SL, Dutch (Determined by Destination)	411091-008	1
69		Label, Top, English (Determined by Destination)	411091-009	1
69		Label, Top, German (Determined by Destination)	411091-010	1
69		Label, Top, French (Determined by Destination)	411091-011	1
69		Label, Top, Swedish (Determined by Destination)	411091-012	1
69		Label, Top, Spanish (Determined by Destination)	411091-013	1
69		Label, Top, Italian (Determined by Destination)	411091-014	1
69		Label, Top, Dutch (Determined by Destination)	411091-015	1
70		Label, 60 Hertz (Determined by Destination)	411091-018	1
70		Label, 50 Hertz (Determined by Destination)	411091-019	1
71		Label, Cover, English (Determined by Destination)	411091-016	1

Item	Reference Designation	Parts List	Part Number	Qty
71		Label, Cover, German (Determined by Destination)	411091-020	1
71		Label, Cover, French (Determined by Destination)	411091-021	1
71		Label, Cover, Swedish (Determined by Destination)	411091-022	1
71		Label, Cover, Spanish (Determined by Destination)	411091-023	1
71		Label, Cover, Italian (Determined by Destination)	411091-024	1
71		Label, Cover, International (Determined by Destination)	411091-025	1
72		Label, TUV (Determined by Destination)	408103-003	1
72		Label, UL Listed (Determined by Destination)	408230-002	1
73	P1	Connector, Header, 64-Pin, w/Ferrites	409203-001	1
74		Adhesive, Diecut, Front Left	415098-002	1
76		Spring, Chassis Ground, Small	414610-001	AR
77		Adhesive, Mylar	415316-001	1
78		Label, CE Mark	408230-008	1
79		PC Post, 2 x 7	412062-004	1
80		PC Post, 2 x 11	412062-005	1

Assembly Revisions PN 411024

The baseline revision for this assembly is pn 411024-001J. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 411024-001B

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 800SL Module, 10-Lead	411025-001	417123-001	1
11		Label Set, Tram 800SL	411091-001	Not Used	1
12		Module Processor PCB	800210-002	800210-005	1
42		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
53	A6	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1
63		Screw, Phillips, STT, 4-40 x 3/16	Not Used	4502-406	2
73		Connector, Header 64-pin w/Ferrites	Not Used	409203-001	1
74		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411024-001C

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 800SL Module, 10-Lead	411025-001	417123-001	1
12		Module Processor PCB	800210-002	800210-005	1
53	A6	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1
42		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
74		Adhesive, Diecut Front Left	Not Used	415098-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411024-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 411024-001C for changes to the parts list.

PN 411024-001E

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 800SL Module, 10-Lead	411025-001	417123-001	1
12		Module Processor PCB	800210-002	800210-005	1
53	A6	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1
76		Spring, Chassis Ground, Small	Not Used	414610-001	AR
77		Adhesive, Mylar	Not Used	415316-001	1
78		Label, CE Mark	Not Used	408230-008	1
79		PC Post, 2 x 7	Not Used	412062-004	1
80		PC Post, 2 x 11	Not Used	412062-005	1

PN 411024-001F

This revision was a documentation change that does not affect this manual.
Refer to pn 411024-001E for changes to the parts list.

PN 411024-001G

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 800SL Module, 10-Lead	411025-001	417123-001	1
53	A6	NBP Valve Assembly	413021-001	416153-001	1
54	A8	NBP PCB	800316-001	800316-002	1

PN 411024-001H

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
5	A9	DAS 800SL Module, 10-Lead	411025-001	417123-001	1
54	A8	NBP PCB	800316-001	800316-002	1

16 TRAM 850A/SL MODULE PN 412657/412658

General **16-2**
Circuit Boards 16-2

Exploded View PN 412657-001H **16-3**

Schematic Diagram PN 412657-001H **16-5**

Parts List PN 412657-001H **16-7**

Assembly Revisions PN 412657 .... **16-10**

Exploded View PN 412658-001H **16-12**

Schematic Diagram PN 412658-001H **16-14**

Parts List PN 412658-001H **16-16**

Assembly Revisions PN 412658 .... **16-19**

General

Circuit Boards

Details about the circuit boards contained in the Tram 850A/SL are discussed in later chapters arranged by part number.

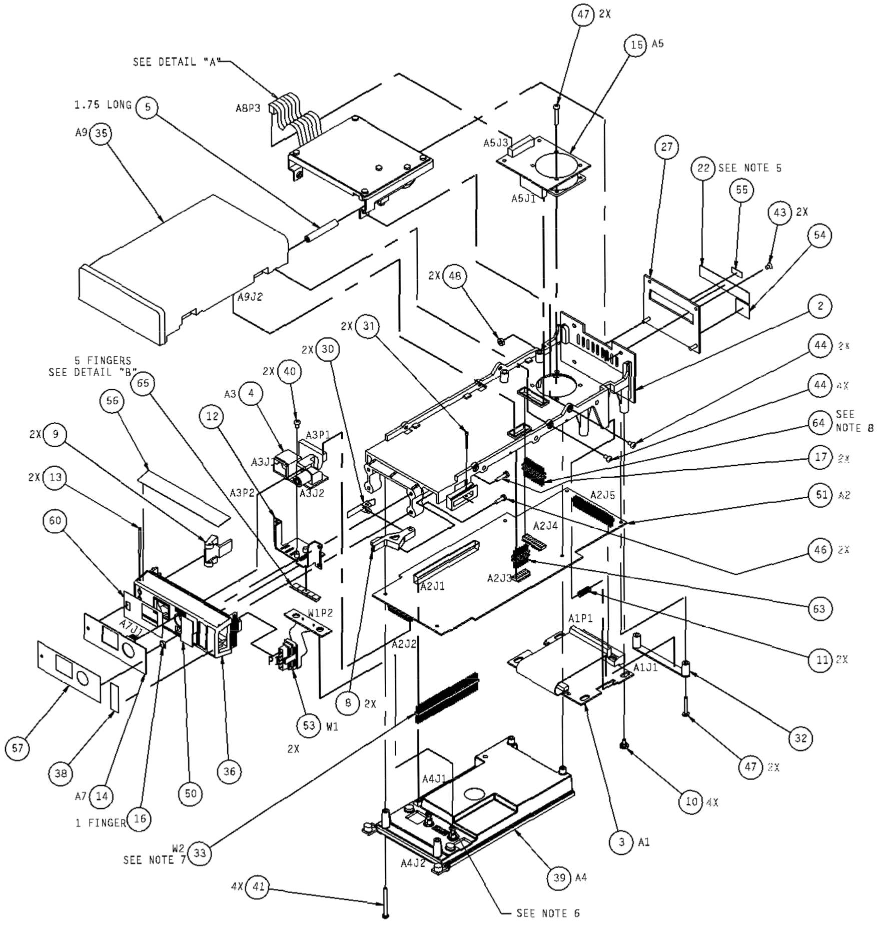
Table 15-1. Circuit Board Overview

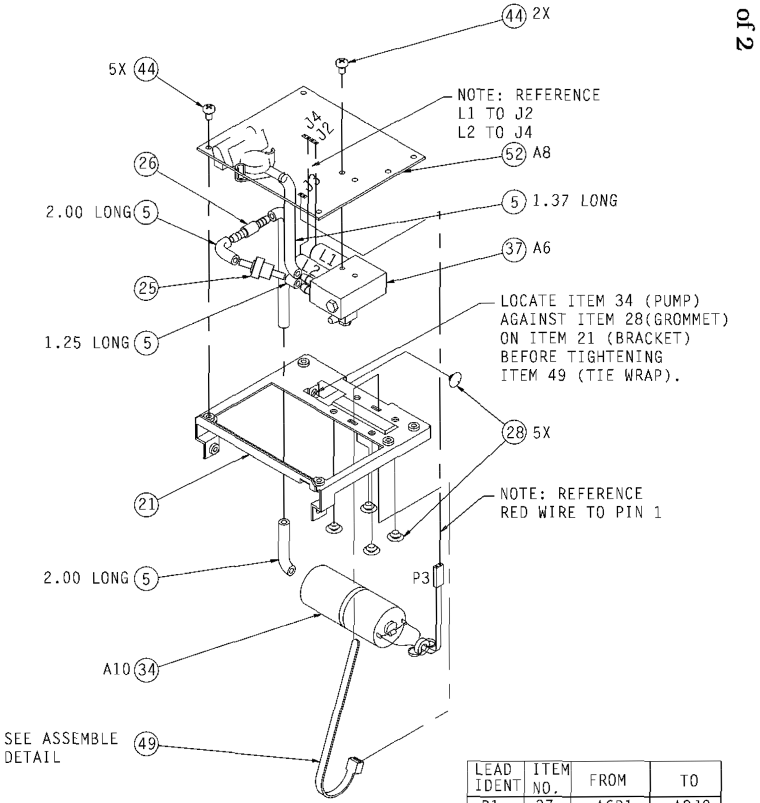
Module Type	Upper Level	Leadwire Configuration	DAS Module	Acquisition Processor PCB	Module Processor PCB
Tram 850A	412657-001A–G	5-Leadwire	411068-001	800330-011	800210-005
Tram 850A	412657-001H	5-Leadwire	417124-001 (Replaces 411068-001)	801040-001	800210-005
Tram 850SL	412658-001A–G	10-Leadwire	411025-001	800330-012	800210-005
Tram 850SL	412658-001H	10-Leadwire	417123-001 (Replaces 411025-001)	801040-001	800210-005

Exploded View

PN 412657-001H

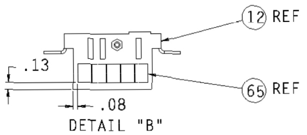
1 of 2


SEE DETAIL "A"
1.75 LONG (5)
A9 (35)
A8P3
A5J3
A5J1
A9J2
(47) 2X
(15) A5
(27)
(22) SEE NOTE 5
(55)
(43) 2X
(54)
(2)
(44) 2X
(44) 4X
(64) SEE NOTE 8
(17) 2X
(51) A2
(46) 2X
(63)
(11) 2X
(32)
(47) 2X
(10) 4X
(3) A1
(39) A4
SEE NOTE 6
4X (41)
W2 SEE NOTE 7 (33)
2X (48)
2X (31)
2X (30)
2X (40)
A3 (4)
(12)
5 FINGERS SEE DETAIL "B" (65)
(56)
2X (9)
2X (13)
(60)
(57)
(38)
A7 (14)
1 FINGER (16)
(50)
(36)
(53) W1
2X
(8) 2X
A3P1
A3J1
A3J2
A3P2
W1P2
A2J5
A2J4
A2J3
A2J1
A2J2
A1P1
A1J1
A4J1
A4J2
A7J1


(44) 2X
5X (44)
NOTE: REFERENCE
L1 TO J2
L2 TO J4
(52) A8
(26)
2.00 LONG (5)
(5) 1.37 LONG
(37) A6
(25)
1.25 LONG (5)
LOCATE ITEM 34 (PUMP) AGAINST ITEM 28(GROMMET) ON ITEM 21 (BRACKET) BEFORE TIGHTENING ITEM 49 (TIE WRAP).
(28) 5X
(21)
NOTE: REFERENCE RED WIRE TO PIN 1
2.00 LONG (5)
P3
A10 (34)
SEE ASSEMBLE DETAIL (49)
J4
J2
L1
L2

LEAD IDENT	ITEM NO.	FROM	TO
P1	37	A6P1	A8J2
P2	37	A6P2	A8J4
P3	34	A10P3	A8J3

DETAIL "A"

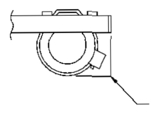

(12) REF
(65) REF
.13
.08

DETAIL "B"

(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 12)

NOTES:

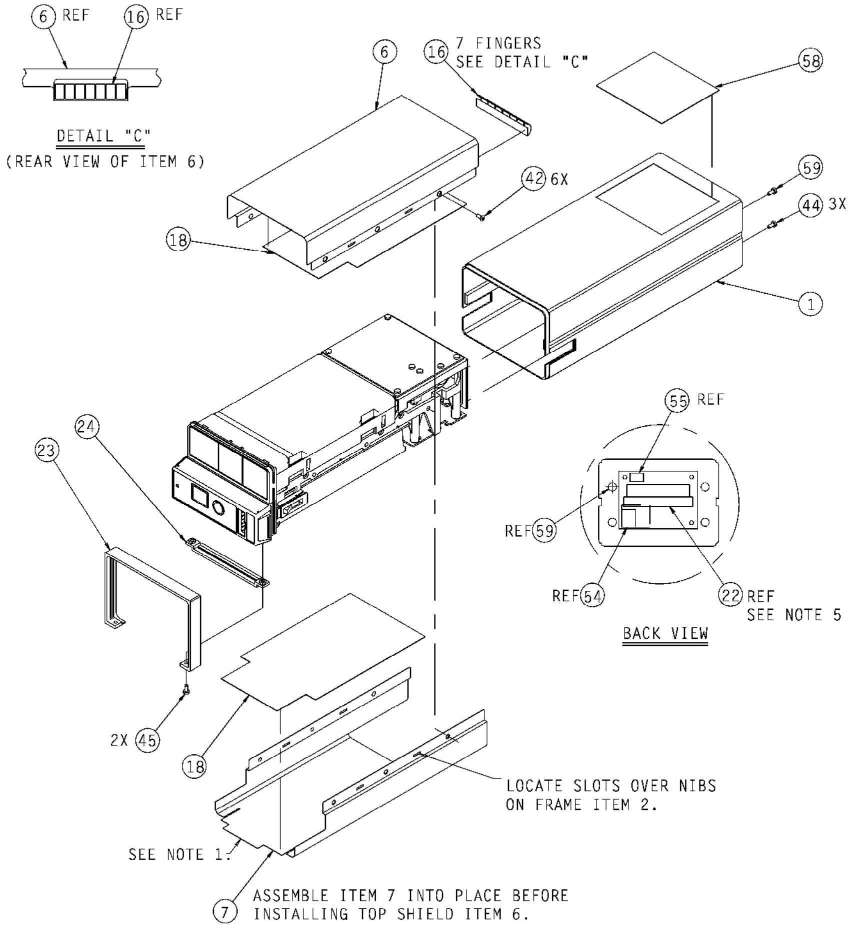
1. WHEN SHIELD (ITEM 7) IS INSTALLED, THE TAB SHOULD TUCK INTO THE FRONT BEZEL (ITEM 36) AND BE IN CONTACT WITH THE SHIELDING FINGERS (ITEM 16) ON THE BOTTOM OF THE BRACKET (ITEM 12).
2. SWITCH SETTINGS MUST BE MADE FOR EACH CONFIGURATION (SEE SWITCH CHART SHEET 2).
3. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
4. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.
5. MARK LABEL WITH MODEL NUMBER, SERIAL NUMBER, AND BAR CODE.
6. INSERT TWO HOLES OF FLEX PCB (ITEM 53) ONTO 1/4-TURN STANDOFF (ITEM 39) UNTIL CONNECTOR ON PCB FLEX BOTTOMS OUT. THEN LOCK THE STANDOFFS BY TURNING THE HEX SCREW OF THE STANDOFF 1/4-TURN CLOCKWISE.
7. INSERT THE SHORT LEADS OF CONNECTOR (ITEM 33) INTO PCB TRAM CPU (ITEM 51).
8. INSERT LONGER PIN SIDE INTO ITEM 51. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 51 WHEN ASSEMBLED.

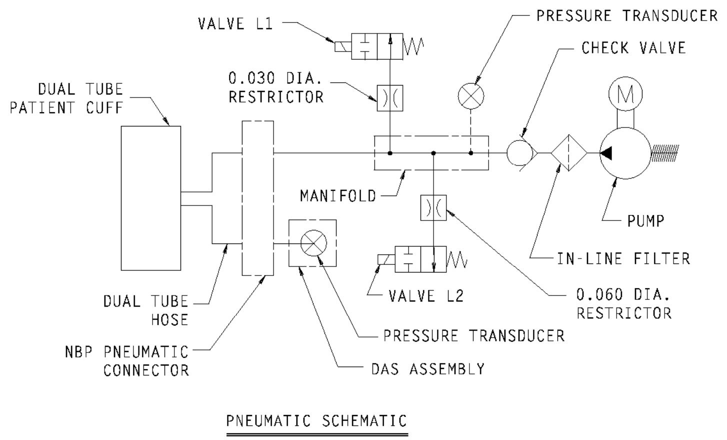


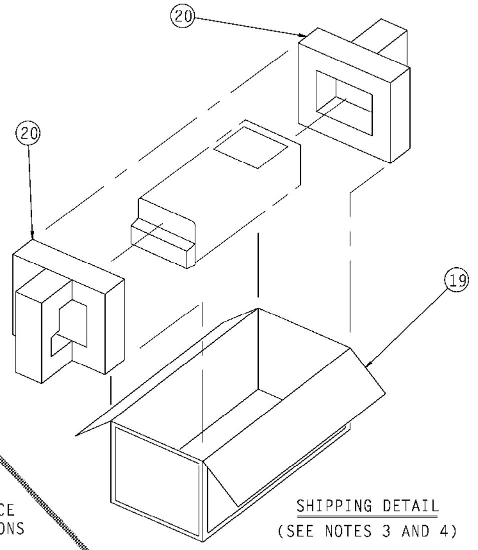
ASSEMBLED DETAIL

NOTE: HEAD OF TIE WRAP ITEM 49 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY.

2 of 2


6 REF
16 REF
DETAIL "C"
(REAR VIEW OF ITEM 6)
6
16 7 FINGERS SEE DETAIL "C"
58
42 6X
59
44 3X
18
1
23
24
55 REF
REF 59
REF 54
22 REF SEE NOTE 5
BACK VIEW
2X 45
18
LOCATE SLOTS OVER NIBS ON FRAME ITEM 2.
SEE NOTE 1.
7 ASSEMBLE ITEM 7 INTO PLACE BEFORE INSTALLING TOP SHIELD ITEM 6.

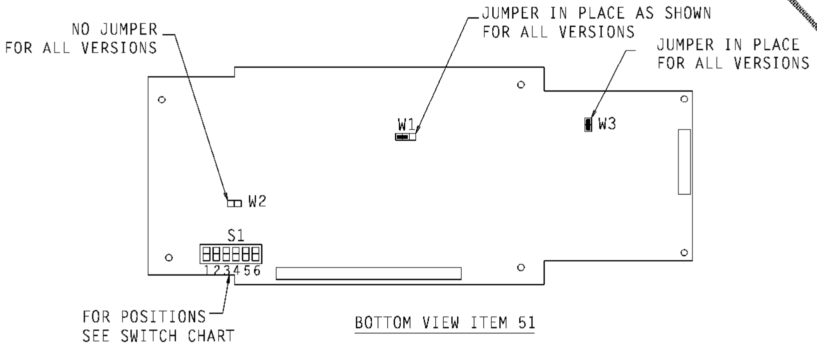

VALVE L1
PRESSURE TRANSDUCER
CHECK VALVE
M
DUAL TUBE PATIENT CUFF
0.030 DIA. RESTRICTOR
MANIFOLD
PUMP
IN-LINE FILTER
VALVE L2
0.060 DIA. RESTRICTOR
DUAL TUBE HOSE
PRESSURE TRANSDUCER
NBP PNEUMATIC CONNECTOR
DAS ASSEMBLY
PNEUMATIC SCHEMATIC


20
20
19
SHIPPING DETAIL
(SEE NOTES 3 AND 4)

SWITCH CHART

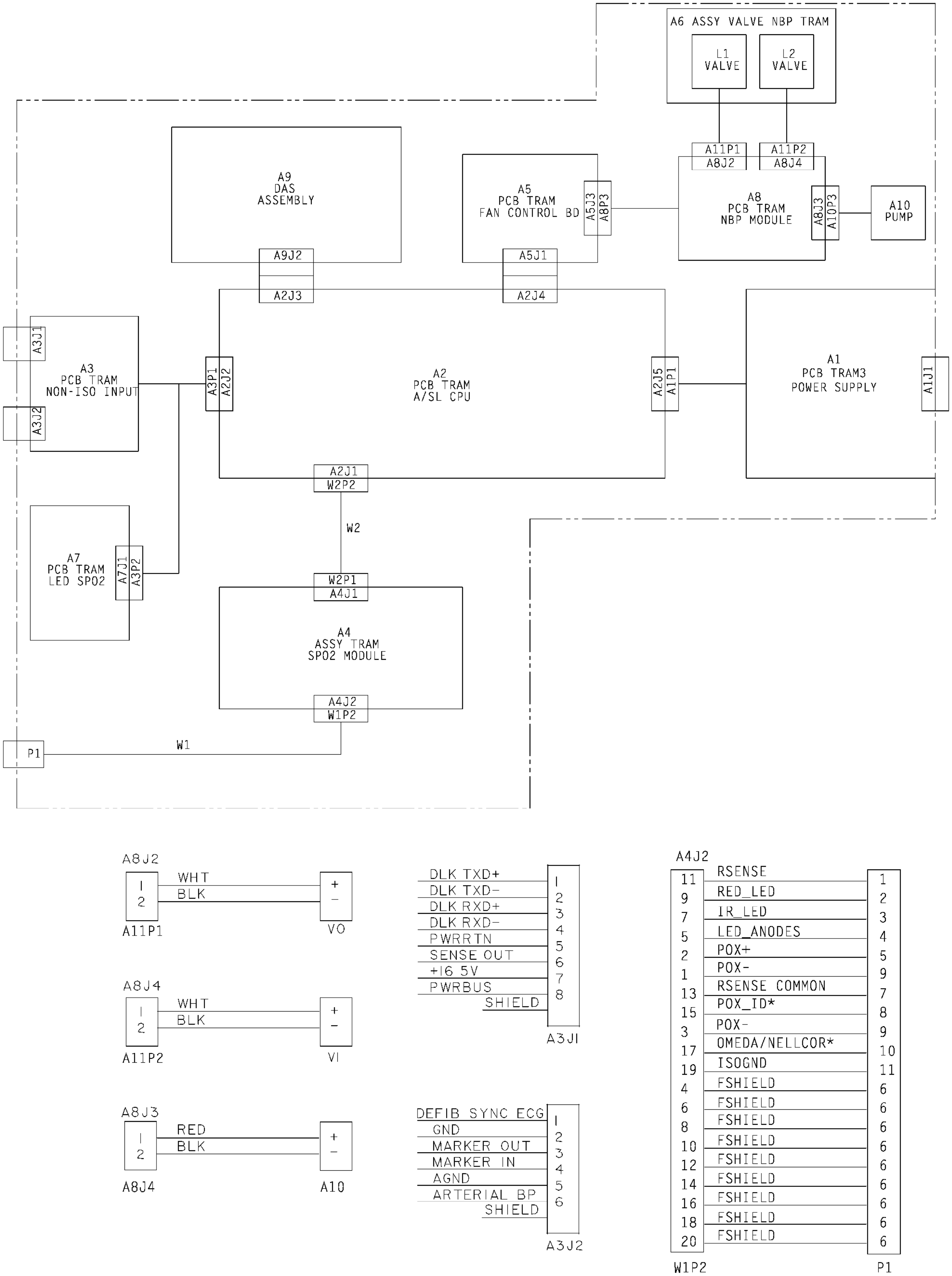
(SEE NOTE 2)

DESCRIPTION	SW1 1	SW1 2	SW1 3	SW1 4	SW1 5	SW1 6	OMAR NUMBER
ENG 60HZ	OFF	OFF	OFF	OFF	OFF	OFF	T250 T450 T850 T850SL =A,G
ENG 50HZ	OFF	OFF	OFF	OFF	OFF	ON	T250 T450 T850 T850SL =A5
SI 60HZ	OFF	OFF	OFF	OFF	ON	OFF	T250 T450 T850 T850SL =Q
SI 50HZ	OFF	OFF	OFF	OFF	ON	ON	T250 T450 T850 T850SL =S,H,T,J,P,W


NO JUMPER FOR ALL VERSIONS
JUMPER IN PLACE AS SHOWN FOR ALL VERSIONS
JUMPER IN PLACE FOR ALL VERSIONS
W1
W3
W2
S1
123456
FOR POSITIONS SEE SWITCH CHART
BOTTOM VIEW ITEM 51

Schematic Diagram PN 412657-001H

1 of 2


A6 ASSY VALVE NBP TRAM
L1 VALVE
L2 VALVE
A11P1
A8J2
A11P2
A8J4
A9 DAS ASSEMBLY
A9J2
A2J3
A5 PCB TRAM FAN CONTROL BD
A5J3
A8P3
A5J1
A2J4
A8 PCB TRAM NBP MODULE
A8J3
A10P3
A10 PUMP
A3J1
A3 PCB TRAM NON-ISO INPUT
A3J2
A3P1
A2J2
A2 PCB TRAM A/SL CPU
A2J5
A1P1
A1 PCB TRAM3 POWER SUPPLY
A1J1
A2J1
W2P2
W2
W2P1
A4J1
A7 PCB TRAM LED SPO2
A7J1
A3P2
A4 ASSY TRAM SPO2 MODULE
A4J2
W1P2
P1
W1
A8J2
1
2
WHT
BLK
+
−
A11P1
VO
A8J4
1
2
WHT
BLK
+
−
A11P2
VI
A8J3
1
2
RED
BLK
+
−
A8J4
A10
DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16 5V 7
PWRBUS 8
SHIELD
A3J1
DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2
A4J2
11 RSENSE 1
9 RED_LED 2
7 IR_LED 3
5 LED_ANODES 4
2 POX+ 5
1 POX- 9
13 RSENSE COMMON 7
15 POX_ID* 8
3 POX- 9
17 OMEDA/NELLCOR* 10
19 ISOGND 11
4 FSHIELD 6
6 FSHIELD 6
8 FSHIELD 6
10 FSHIELD 6
12 FSHIELD 6
14 FSHIELD 6
16 FSHIELD 6
18 FSHIELD 6
20 FSHIELD 6
W1P2
P1

2 of 2

	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD ATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBU	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J5		A1J2
1	ART BP	1
2	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	9
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
15	+12 8 ANALOG	15
16	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40

A1P1

A3J3		A2J2
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20
W2P2		
A7J1		
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24
A3P1		W2P1

A4J1		A2J1
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64
W2P1		W2P2

A2J4		A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A9J2		A2J3
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A5J3		A8P3
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+12V SW	8
9	NIBP P5	9
10	+12V SW	10
11	NIBP P4	11
12	SPARE	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
23	GND	23
24	+5V	24

Parts List PN 412657-001H

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3	A1	Power Supply PCB Assembly	401309-002	1
4	A3	Non-Isolated Input PCB Assembly	401315-002	1
5		Tubing, Silastic	401582-001	AR
6		Shield, Top	401679-001	1
7		Shield, Bottom	401679-002	1
8		Latch	401682-001	2
9		Button, Latch	402106-001	2
10		Screw, Shoulder	402214-001	4
11		Spring, Compression	402315-001	2
12		Plate, Chassis Ground, Bottom/Front	402317-001	1
13		Pin, Latch	402806-001	2
14	A7	Power Indicator PCB	403170-011	1
15	A5	Fan PCB	403549-002	1
16		Spring, Chassis Ground, Rear	403741-001	AR
17		Screw, BDGH, Phillips, 4-40 x 7/8	404069-001	2
18		Insulator, Bottom Shield	404188-001	2
19		Carton, Shipping	404211-003	1
20		Foam, Insert	404211-004	1
21		Bracket, NBP Mounting	404296-001	1
22		Label, Blank	404525-006	1
23		Trim, Rubber, Front Bezel	404620-001	1
24		Mounting Strap, Trim	404621-001	1
25		Check Valve, 0.125 ID	404675-001	1
26		Filter, 43 Micron	404679-001	1
27		Plate, Chassis Ground, Rear	404680-002	1
28		Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness	404749-001	5
30		Spring, Latch	406019-001	2
31		Pin, Latch	406037-001	2
32		Bracket, Power Supply PCB	406254-001	1
33	W2	Connector, Header, Dual, 64-Pin	407452-002	1
34	A10	Pump Assembly, NBP, w/Harness	408169-002	1
35	A9	800 Acquisition Module, 5-Lead	417124-001	1
36		Front Bezel, Tram	412659-001	1
37	A6	NBP Valve Assembly	416153-001	1
38		Label, Pulse Oximetry, Nellcor (Determined by Destination)	413831-002	1
39	A4	Pulse Oximetry Assembly (Including Pulse Oximetry PCB, PN 800674-00X)	414409-001	1
40		Screw, BDGH, Phillips, 4-40 x 3/16	4502-406	2

Item	Reference Designation	Parts List	Part Number	Qty
41		Screw, BDGH, Phillips, 4-40 x 1-1/4	4502-440	4
42		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
43		Screw, FLH, Phillips, SST, 4-40 x 3/8	4505-412	2
44		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	15
45		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
46		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
47		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
48		Nut, Hex, 4-40	4521-304	2
49		Tie Wrap	4535-002	1
50		Adhesive, Diecut, Front Right	415098-003	AR
51	A2	Module Processor PCB	800210-005	1
52	A8	NPB PCB	800316-002	1
53	W1	Harness, Pulse Oximetry PCB-to-Connector	800892-001	1
54		Label, UL Listed (Determined by Destination)	40230-003	1
55		Label, 60 Hertz (Determined by Destination)	411091-018	1
55		Label, 50 Hertz (Determined by Destination)	411091-019	1
56		Label, Top, English (Determined by Destination)	411091-009	1
56		Label, Top, German (Determined by Destination)	411091-010	1
56		Label, Top, French (Determined by Destination)	411091-011	1
56		Label, Top, Swedish (Determined by Destination)	411091-012	1
56		Label, Top, Spanish (Determined by Destination)	411091-013	1
56		Label, Top, Italian (Determined by Destination)	411091-014	1
56		Label, Top, Dutch (Determined by Destination)	411091-015	1
57		Label, Front, 850A, English (Determined by Destination)	413841-001	1
57		Label, Front, 850A, German (Determined by Destination)	413841-002	1
57		Label, Front, 850A, French (Determined by Destination)	413841-003	1
57		Label, Front, 850A, Swedish (Determined by Destination)	413841-004	1
57		Label, Front, 850A, Spanish (Determined by Destination)	413841-005	1
57		Label, Front, 850A, Italian (Determined by Destination)	413841-006	1
57		Label, Front, 850A, Dutch (Determined by Destination)	413841-007	1
58		Label, Cover, English (Determined by Destination)	414051-001	1
58		Label, Cover, German (Determined by Destination)	414051-002	1
58		Label, Cover, French (Determined by Destination)	414051-003	1
58		Label, Cover, Swedish (Determined by Destination)	414051-004	1
58		Label, Cover, Spanish (Determined by Destination)	414051-005	1
58		Label, Cover, Italian (Determined by Destination)	414051-006	1
58		Label, Cover, International (Determined by Destination)	414051-007	1

Item	Reference Designation	Parts List	Part Number	Qty
59		Screw, PHD, 4-40 x 0.188, Modified (Determined byDestination)	409009-001	1
59		Screw, PHD, 4-40 x 0.188 (Determined by Destination)	45074-406	1
60		Adhesive, Diecut, Front Left	415098-002	1
61		Tram 100 - 850 A and SL Module Service Manual	404422-065	1
62		Label, CE Mark	408230-008	1
63		PC Post, 2 x 7	412062-004	1
64		PC Post, 2 x 11	412062-005	1
65		Spring, Chassis Ground, Small	414610-001	AR

Assembly Revisions PN 412657

The baseline revision for this assembly is pn 412657-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 412657-001A

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 800A Module, 5-Lead	411068-001	417124-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
50		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
51		Module Processor PCB	800210-002	800210-005	1
52	A8	NBP PCB	800316-001	800316-002	1
59		Spring, Chassis Ground, Small	Not Used	414610-001	AR
60		Adhesive, Diecut Front Left	Not Used	415098-002	1
62		Label, CE Mark	Not Used	408230-008	1
63		PC Post, 2 x 7	Not Used	412062-004	1
64		PC Post, 2 x 11	Not Used	412062-005	1

PN 412657-001B

This revision was a documentation change that does not affect this manual.
Refer to pn 412657-001A for changes to the parts list.

PN 412657-001C

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 800A Module, 5-Lead	411068-001	417124-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
51		Module Processor PCB	800210-002	800210-005	1
52	A8	NBP PCB	800316-001	800316-002	1
62		Label, CE Mark	Not Used	408230-008	1
63		PC Post, 2 x 7	Not Used	412062-004	1
64		PC Post, 2 x 11	Not Used	412062-005	1

PN 412657-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 412657-001C for changes to the parts list.

PN 412657-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 412657-001C for changes to the parts list.

PN 412657-001F

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 800A Module, 5-Lead	411068-001	417124-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
52	A8	NBP PCB	800316-001	800316-002	1

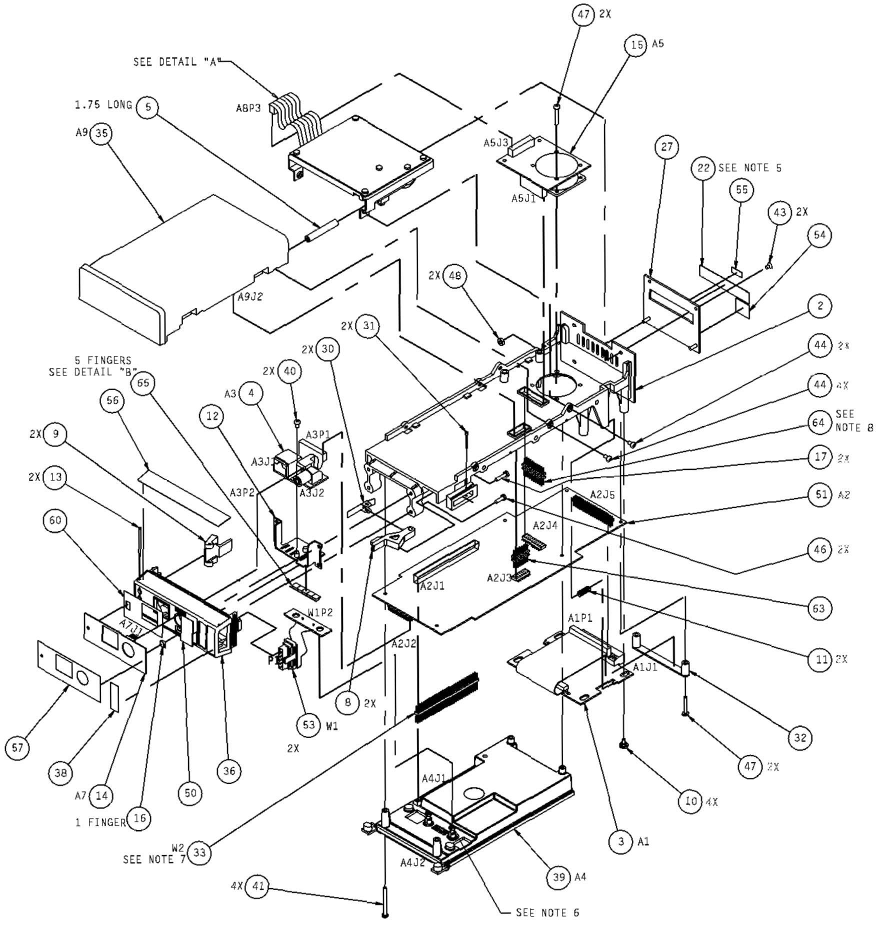
PN 412657-001G

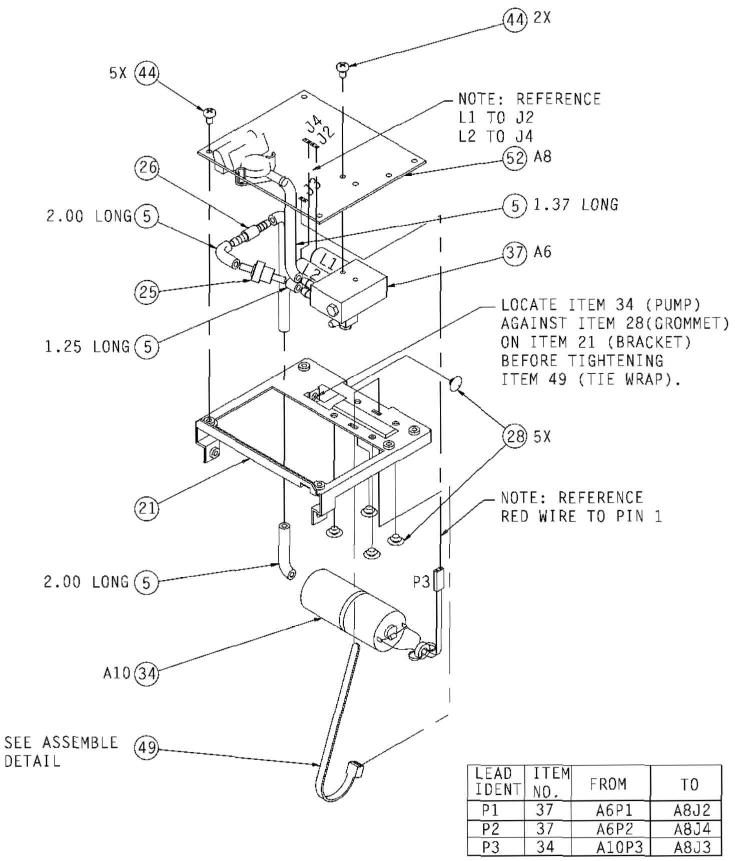
Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 800A Module, 5-Lead	411068-001	417124-001	1
52	A8	NBP PCB	800316-001	800316-002	1

Exploded View

PN 412658-001H

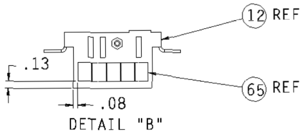
1 of 2


47 2X
15 A5
SEE DETAIL "A"
1.75 LONG 5
A9 35
A6P3
A5J3
A5J1
27
22 SEE NOTE 5
55
43 2X
54
2
A9J2
2X 48
2X 31
2X 30
2X 40
5 FINGERS SEE DETAIL "B"
65
56
A3 4
12
A3P1
A3J1
A3J2
A3P2
2X 9
2X 13
60
44 2X
44 4X
64 SEE NOTE 8
17 2X
51 A2
A2J5
A2J4
A2J3
A2J1
A2J2
46 2X
63
11 2X
A1P1
A1J1
W1P2
8 2X
53 W1
2X
32
47 2X
10 4X
3 A1
A4J1
A4J2
39 A4
SEE NOTE 6
A7
57
38
A7 14
50
36
1 FINGER 16
W2 SEE NOTE 7 33
4X 41


44 2X
5X 44
NOTE: REFERENCE
L1 TO J2
L2 TO J4
J4
J2
52 A8
26
5 1.37 LONG
2.00 LONG 5
L1
L2
37 A6
25
1.25 LONG 5
LOCATE ITEM 34 (PUMP) AGAINST ITEM 28(GROMMET) ON ITEM 21 (BRACKET) BEFORE TIGHTENING ITEM 49 (TIE WRAP).
28 5X
21
NOTE: REFERENCE RED WIRE TO PIN 1
2.00 LONG 5
P3
A10 34
SEE ASSEMBLE DETAIL 49

LEAD IDENT	ITEM NO.	FROM	TO
P1	37	A6P1	A8J2
P2	37	A6P2	A8J4
P3	34	A10P3	A8J3

DETAIL "A"

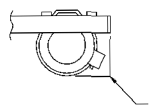

12 REF
65 REF
.13
.08

DETAIL "B"

(LOCATE APPROXIMATELY AS SHOWN)
(BOTTOM VIEW OF ITEM 12)

NOTES:

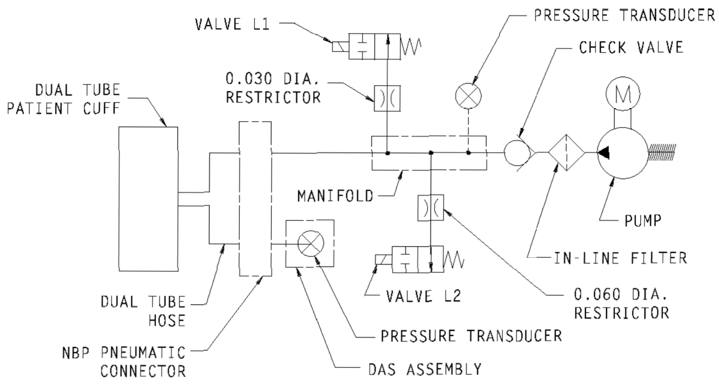
1. WHEN SHIELD (ITEM 7) IS INSTALLED, THE TAB SHOULD TUCK INTO THE FRONT BEZEL (ITEM 36) AND BE IN CONTACT WITH THE SHIELDING FINGERS (ITEM 16) ON THE BOTTOM OF THE BRACKET (ITEM 12).
2. SWITCH SETTINGS MUST BE MADE FOR EACH CONFIGURATION (SEE SWITCH CHART SHEET 2).
3. CHECK APPROPRIATE BOX ON SIDE OF CARTON TO INDICATE UNIT BEING SHIPPED.
4. LOOSE ITEMS MAY BE SHIPPED WITH THE UNIT IF SPACE PERMITS OR PACKAGED AND SHIPPED SEPARATELY.
5. MARK LABEL WITH MODEL NUMBER, SERIAL NUMBER, AND BAR CODE.
6. INSERT TWO HOLES OF FLEX PCB (ITEM 53) ONTO 1/4-TURN STANDOFF (ITEM 39) UNTIL CONNECTOR ON PCB FLEX BOTTOMS OUT. THEN LOCK THE STANDOFFS BY TURNING THE HEX SCREW OF THE STANDOFF 1/4-TURN CLOCKWISE.
7. INSERT THE SHORT LEADS OF CONNECTOR (ITEM 33) INTO PCB TRAM CPU (ITEM 51).
8. INSERT LONGER PIN SIDE INTO ITEM 51. PINS MUST EXTEND BEYOND MATING CONNECTOR ON ITEM 51 WHEN ASSEMBLED.



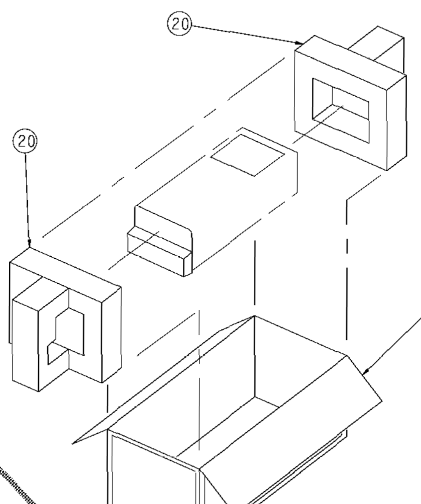
ASSEMBLED DETAIL

NOTE: HEAD OF TIE WRAP ITEM 49 MUST NOT BREAK EITHER OF THESE PLANES AFTER ASSEMBLY.

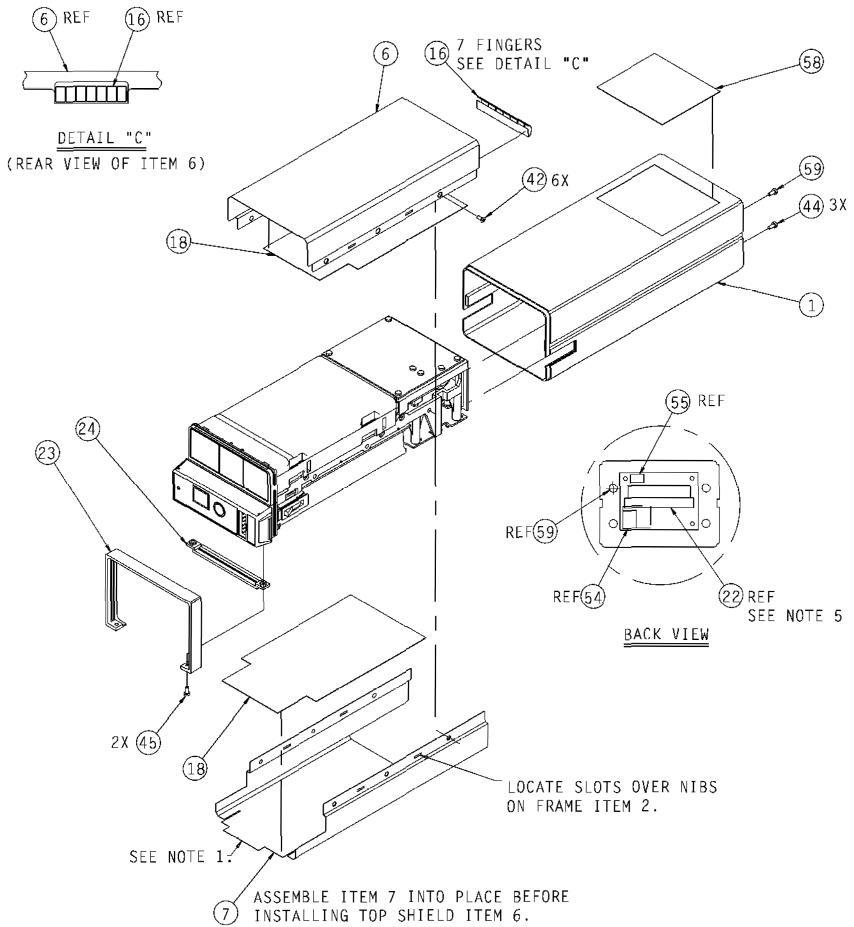
2 of 2


VALVE L1
PRESSURE TRANSDUCER
CHECK VALVE
DUAL TUBE
PATIENT CUFF
0.030 DIA.
RESTRICTOR
M
MANIFOLD
PUMP
IN-LINE FILTER
VALVE L2
0.060 DIA.
RESTRICTOR
DUAL TUBE
HOSE
PRESSURE TRANSDUCER
NBP PNEUMATIC
CONNECTOR
DAS ASSEMBLY

PNEUMATIC SCHEMATIC



SHIPPING DETAIL
(SEE NOTES 3 AND 4)


6 REF
16 REF
6
16 7 FINGERS
SEE DETAIL "C"
58
42 6X
59
44 3X
18
1
55 REF
REF 59
REF 54
22 REF
SEE NOTE 5
24
23
2X 45
18
LOCATE SLOTS OVER NIBS
ON FRAME ITEM 2.
SEE NOTE 1.
7 ASSEMBLE ITEM 7 INTO PLACE BEFORE
INSTALLING TOP SHIELD ITEM 6.

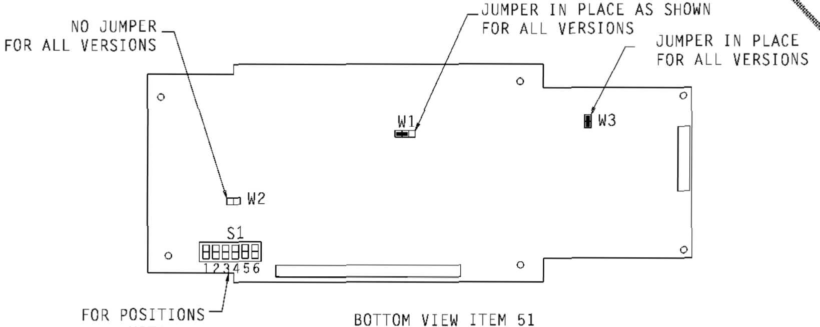
DETAIL "C"
(REAR VIEW OF ITEM 6)

BACK VIEW

SWITCH CHART
(SEE NOTE 2)

■ =ON
□ =OFF

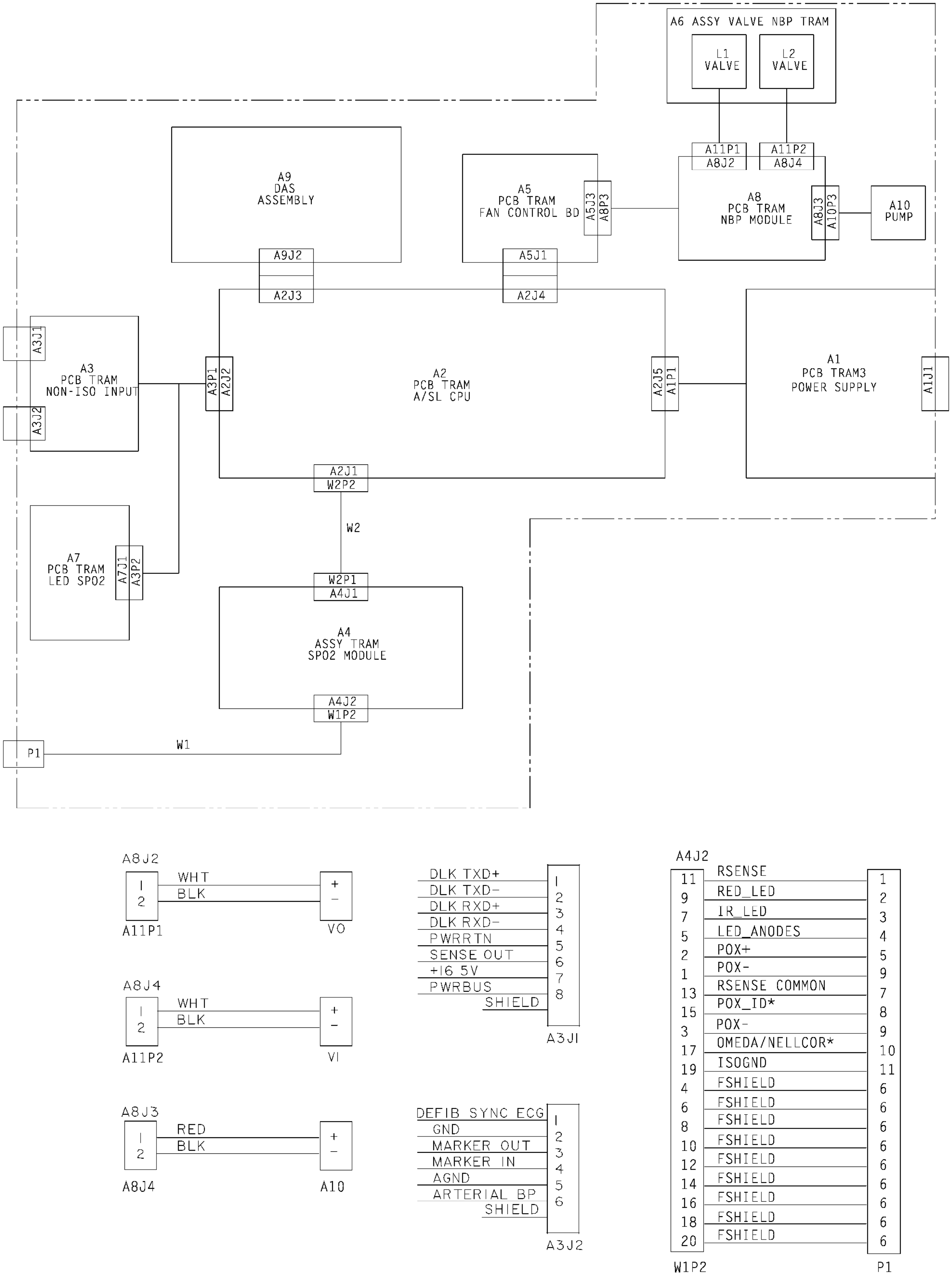
DESCRIPTION	SW1 123456	OMAR NUMBER
ENG 60HZ	□□□□□□	T250 T450 T850 T850SL =A,G
ENG 50HZ	□□□□□■	T250 T450 T850 T850SL =A5
SI 60HZ	□□□□■□	T250 T450 T850 T850SL =Q
SI 50HZ	□□□□■■	T250 T450 T850 T850SL =S,H,T,J,P,W


NO JUMPER
FOR ALL VERSIONS
JUMPER IN PLACE AS SHOWN
FOR ALL VERSIONS
JUMPER IN PLACE
FOR ALL VERSIONS
W1
W3
W2
S1
123456
FOR POSITIONS
SEE SWITCH CHART

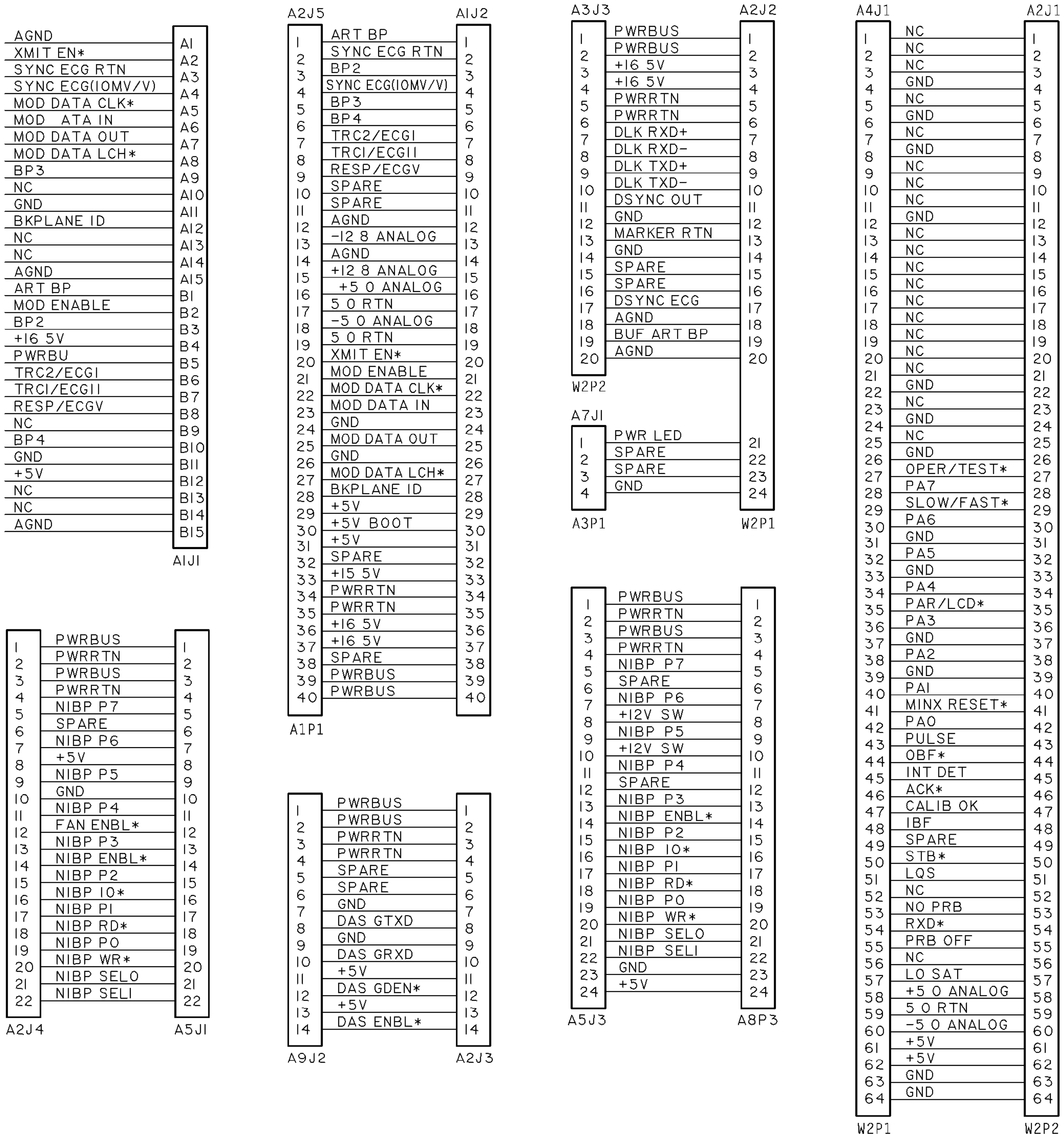
BOTTOM VIEW ITEM 51

Schematic Diagram PN 412658-001H

1 of 2


A6 ASSY VALVE NBP TRAM
L1 VALVE
L2 VALVE
A11P1
A8J2
A11P2
A8J4
A9 DAS ASSEMBLY
A9J2
A2J3
A5 PCB TRAM FAN CONTROL BD
A5J3
A8P3
A5J1
A2J4
A8 PCB TRAM NBP MODULE
A8J3
A10P3
A10 PUMP
A3J1
A3 PCB TRAM NON-ISO INPUT
A3J2
A3P1
A2J2
A2 PCB TRAM A/SL CPU
A2J5
A1P1
A1 PCB TRAM3 POWER SUPPLY
A1J1
A2J1
W2P2
W2
W2P1
A4J1
A7 PCB TRAM LED SPO2
A7J1
A3P2
A4 ASSY TRAM SPO2 MODULE
A4J2
W1P2
P1
W1
A8J2
1
2
WHT
BLK
+
−
A11P1
VO
A8J4
1
2
WHT
BLK
+
−
A11P2
V1
A8J3
1
2
RED
BLK
+
−
A8J4
A10
DLK TXD+ 1
DLK TXD− 2
DLK RXD+ 3
DLK RXD− 4
PWRRTN 5
SENSE OUT 6
+16 5V 7
PWRBUS 8
SHIELD
A3J1
DEFIB SYNC ECG 1
GND 2
MARKER OUT 3
MARKER IN 4
AGND 5
ARTERIAL BP 6
SHIELD
A3J2
A4J2
11 RSENSE 1
9 RED_LED 2
7 IR_LED 3
5 LED_ANODES 4
2 POX+ 5
1 POX− 9
13 RSENSE COMMON 7
15 POX_ID* 8
3 POX− 9
17 OMEDA/NELLCOR* 10
19 ISOGND 11
4 FSHIELD 6
6 FSHIELD 6
8 FSHIELD 6
10 FSHIELD 6
12 FSHIELD 6
14 FSHIELD 6
16 FSHIELD 6
18 FSHIELD 6
20 FSHIELD 6
W1P2
P1

2 of 2



	A1J1
AGND	A1
XMIT EN*	A2
SYNC ECG RTN	A3
SYNC ECG(10MV/V)	A4
MOD DATA CLK*	A5
MOD ATA IN	A6
MOD DATA OUT	A7
MOD DATA LCH*	A8
BP3	A9
NC	A10
GND	A11
BKPLANE ID	A12
NC	A13
NC	A14
AGND	A15
ART BP	B1
MOD ENABLE	B2
BP2	B3
+16 5V	B4
PWRBU	B5
TRC2/ECGI	B6
TRC1/ECGII	B7
RESP/ECGV	B8
NC	B9
BP4	B10
GND	B11
+5V	B12
NC	B13
NC	B14
AGND	B15

A2J5		A1J2
1	ART BP	1
2	SYNC ECG RTN	2
3	BP2	3
4	SYNC ECG(10MV/V)	4
5	BP3	5
6	BP4	6
7	TRC2/ECGI	7
8	TRC1/ECGII	8
9	RESP/ECGV	9
10	SPARE	10
11	SPARE	11
12	AGND	12
13	-12 8 ANALOG	13
14	AGND	14
15	+12 8 ANALOG	15
16	+5 0 ANALOG	16
17	5 0 RTN	17
18	-5 0 ANALOG	18
19	5 0 RTN	19
20	XMIT EN*	20
21	MOD ENABLE	21
22	MOD DATA CLK*	22
23	MOD DATA IN	23
24	GND	24
25	MOD DATA OUT	25
26	GND	26
27	MOD DATA LCH*	27
28	BKPLANE ID	28
29	+5V	29
30	+5V BOOT	30
31	+5V	31
32	SPARE	32
33	+15 5V	33
34	PWRRTN	34
35	PWRRTN	35
36	+16 5V	36
37	+16 5V	37
38	SPARE	38
39	PWRBUS	39
40	PWRBUS	40

A1P1

A3J3		A2J2
1	PWRBUS	1
2	PWRBUS	2
3	+16 5V	3
4	+16 5V	4
5	PWRRTN	5
6	PWRRTN	6
7	DLK RXD+	7
8	DLK RXD-	8
9	DLK TXD+	9
10	DLK TXD-	10
11	DSYNC OUT	11
12	GND	12
13	MARKER RTN	13
14	GND	14
15	SPARE	15
16	SPARE	16
17	DSYNC ECG	17
18	AGND	18
19	BUF ART BP	19
20	AGND	20

W2P2

A7J1		A2J2
1	PWR LED	21
2	SPARE	22
3	SPARE	23
4	GND	24

A3P1 W2P1

A4J1		A2J1
1	NC	1
2	NC	2
3	NC	3
4	GND	4
5	NC	5
6	GND	6
7	NC	7
8	GND	8
9	NC	9
10	NC	10
11	NC	11
12	GND	12
13	NC	13
14	NC	14
15	NC	15
16	NC	16
17	NC	17
18	NC	18
19	NC	19
20	NC	20
21	NC	21
22	GND	22
23	NC	23
24	GND	24
25	NC	25
26	GND	26
27	OPER/TEST*	27
28	PA7	28
29	SLOW/FAST*	29
30	PA6	30
31	GND	31
32	PA5	32
33	GND	33
34	PA4	34
35	PAR/LCD*	35
36	PA3	36
37	GND	37
38	PA2	38
39	GND	39
40	PA1	40
41	MINX RESET*	41
42	PA0	42
43	PULSE	43
44	OBF*	44
45	INT DET	45
46	ACK*	46
47	CALIB OK	47
48	IBF	48
49	SPARE	49
50	STB*	50
51	LQS	51
52	NC	52
53	NO PRB	53
54	RXD*	54
55	PRB OFF	55
56	NC	56
57	LO SAT	57
58	+5 0 ANALOG	58
59	5 0 RTN	59
60	-5 0 ANALOG	60
61	+5V	61
62	+5V	62
63	GND	63
64	GND	64

W2P1 W2P2

A2J4		A5J1
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+5V	8
9	NIBP P5	9
10	GND	10
11	NIBP P4	11
12	FAN ENBL*	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22

A9J2		A2J3
1	PWRBUS	1
2	PWRBUS	2
3	PWRRTN	3
4	PWRRTN	4
5	SPARE	5
6	SPARE	6
7	GND	7
8	DAS GTXD	8
9	GND	9
10	DAS GRXD	10
11	+5V	11
12	DAS GDEN*	12
13	+5V	13
14	DAS ENBL*	14

A5J3		A8P3
1	PWRBUS	1
2	PWRRTN	2
3	PWRBUS	3
4	PWRRTN	4
5	NIBP P7	5
6	SPARE	6
7	NIBP P6	7
8	+12V SW	8
9	NIBP P5	9
10	+12V SW	10
11	NIBP P4	11
12	SPARE	12
13	NIBP P3	13
14	NIBP ENBL*	14
15	NIBP P2	15
16	NIBP IO*	16
17	NIBP P1	17
18	NIBP RD*	18
19	NIBP P0	19
20	NIBP WR*	20
21	NIBP SEL0	21
22	NIBP SEL1	22
23	GND	23
24	+5V	24

Parts List PN 412658-001H

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Module	400895-001	1
2		Frame	400982-001	1
3	A1	Power Supply PCB	401309-002	1
4	A3	Non-Isolated Input PCB	401315-002	1
5		Tubing, Silastic	401582-001	AR
6		Shield, Top	401679-001	1
7		Shield, Bottom	401679-002	1
8		Latch	401682-001	2
9		Button, Latch	402106-001	2
10		Screw, Shoulder	402214-001	4
11		Spring, Compression	402315-001	2
12		Plate, Chassis Ground, Bottom/Front	402317-001	1
13		Pin, Latch	402806-001	2
14	A7	Power Indicator PCB	403170-011	1
15	A5	Fan PCB Assembly	403549-002	1
16		Spring, Chassis Ground, Rear	403741-001	AR
17		Screw, BDGH, Phillips, 4-40 x 7/8	404069-001	2
18		Insulator, Bottom Shield	404188-001	2
19		Carton, Shipping	404211-003	1
20		Foam, Insert	404211-004	
21		Bracket, NBP Mounting	404296-001	1
22		Label, Blank	404525-006	1
23		Trim, Rubber, Front Bezel	404620-001	1
24		Mounting Strap, Trim	404621-001	1
25		Check Valve, 0.125 ID	404675-001	1
26		Filter, 43 Micron	404679-001	1
27		Plate, Chassis Ground, Rear	404680-002	1
28		Grommet, 1/4 Dia, 1/8 High, 1/16 Panel Thickness	404749-001	5
29		Spring, Flat, SST	405041-001	2
30		Spring, Latch	406019-001	2
31		Pin, Latch	406037-001	2
32		Bracket, Power Supply PCB	406254-001	1
33	W2	Connector, Header, Dual, 64-Pin	407452-002	1
34	A10	Pump Assembly, NBP, w/Harness	408169-002	1
35	A9	800 Acquisition Module, 10-Lead	417123-001	1
36		Front Bezel, Tram	402659-001	1
37	A6	NBP Valve Assembly	416153-001	1
38		Label, Pulse Oximetry, Nellcor	413831-002	1
39	A4	Pulse Oximetry Assembly (Including Pulse Oximetry PCB, PN 800674-00X)	414409-001	1
40		Screw, BDGH, Phillips, 4-40 x 3/16	4502-406	2

Item	Reference Designation	Parts List	Part Number	Qty
41		Screw, BDGH, Phillips, 4-40 x 1-1/4	4502-440	4
42		Screw, FLH, 100°, Phillips, SST, 4-40 x 3/16	4505-406	6
43		Screw, FLH, Phillips, SST, 4-40 x 3/8	4505-412	2
44		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	16
45		Screw, BDGH, Phillips, 4-40 x 3/8	45074-412	2
46		Screw, BDGH, Phillips, 4-40 x 5/8	45074-420	2
47		Screw, BDGH, Phillips, 4-40 x 3/4	45074-424	4
48		Nut, Hex, 4-40	4521-304	2
49		Tie Wrap	4535-002	1
50		Adhesive, Diecut, Front Right	415098-003	1
51	A2	Module Processor PCB	800210-005	1
52	A8	NPB PCB	800316-002	1
53	W1	Harness, Pulse Oximetry PCB-to-Connector	800892-001	1
54		Label, UL Listed	40230-003	1
55		Label, 60 Hertz	411091-018	1
55		Label, 50 Hertz	411091-019	1
56		Label, Top, English (Determined by Destination)	411091-009	1
56		Label, Top, German (Determined by Destination)	411091-010	1
56		Label, Top, French (Determined by Destination)	411091-011	1
56		Label, Top, Swedish (Determined by Destination)	411091-012	1
56		Label, Top, Spanish (Determined by Destination)	411091-013	1
56		Label, Top, Italian (Determined by Destination)	411091-014	1
56		Label, Top, Dutch (Determined by Destination)	411091-015	1
57		Label, Front, 850SL, English (Determined by Destination)	413842-001	1
57		Label, Front, 850SL, German (Determined by Destination)	413842-002	1
57		Label, Front, 850SL, French (Determined by Destination)	413842-003	1
57		Label, Front, 850SL, Swedish (Determined by Destination)	413842-004	1
57		Label, Front, 850SL, Spanish (Determined by Destination)	413842-005	1
57		Label, Front, 850SL, Italian (Determined by Destination)	413842-006	1
57		Label, Front, 850SL, Dutch (Determined by Destination)	413842-007	1
58		Label, Cover, English (Determined by Destination)	414052-001	1
58		Label, Cover, German (Determined by Destination)	414052-002	1
58		Label, Cover, French (Determined by Destination)	414052-003	1
58		Label, Cover, Swedish (Determined by Destination)	414052-004	1
58		Label, Cover, Spanish (Determined by Destination)	414052-005	1
58		Label, Cover, Italian (Determined by Destination)	414052-006	1
58		Label, Cover, International (Determined by Destination)	414052-007	1

Item	Reference Designation	Parts List	Part Number	Qty
59		Screw, PHD, 4-40 x 0.188, Modified (Determined by Destination)	409009-001	1
59		Screw, PHD, 4-40 x 0.188 (Determined by Destination)	45074-406	1
60		Adhesive, Diecut, Front Left	415098-002	1
61		Tram 100 - 850 A and SL Module Service Manual	404422-065	1
62		Label, CE Mark	408230-008	1
63		PC Post, 2 x 7	412062-004	1
64		PC Post, 2 x 11	412062-005	1
65		Spring, Chassis Ground, Small	414610-001	AR

Assembly Revisions PN 412658

The baseline revision for this assembly is pn 412658-001H. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 412658-001A

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 800SL Module, 10-Lead	411025-001	417123-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
50		Adhesive, Loctite Prism 411	4851-082	415098-001	AR
51		Module Processor PCB	800210-002	800210-005	1
52	A8	NBP PCB	800316-001	800316-002	1
59		Spring, Chassis Ground, Small	Not Used	414610-001	AR
60		Adhesive, Diecut Front Left	Not Used	415098-002	1
62		Label, CE Mark	Not Used	408230-008	1
63		PC Post, 2 x 7	Not Used	412062-004	1
64		PC Post, 2 x 11	Not Used	412062-005	1

PN 412658-001B

This revision was a documentation change that does not affect this manual.
Refer to pn 412658-001A for changes to the parts list.

PN 412658-001C

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 800SL Module, 10-Lead	411025-001	417123-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
51		Module Processor PCB	800210-002	800210-005	1
52	A8	NBP PCB	800316-001	800316-002	1
62		Label, CE Mark	Not Used	408230-008	1
63		PC Post, 2 x 7	Not Used	412062-004	1
64		PC Post, 2 x 11	Not Used	412062-005	1

PN 412658-001D

This revision was a documentation change that does not affect this manual.
Refer to pn 412658-001C for changes to the parts list.

PN 412658-001E

This revision was a documentation change that does not affect this manual.
Refer to pn 412658-001C for changes to the parts list.

PN 412658-001F

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 800SL Module, 10-Lead	411025-001	417123-001	1
37	A6	NBP Valve Assembly	413021-001	416153-001	1
52	A8	NBP PCB	800316-001	800316-002	1

PN 412658-001G

Item	Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
35	A9	DAS 800SL Module, 10-Lead	411025-001	417123-001	1
52	A8	NBP PCB	800316-001	800316-002	1

17

100/200 ACQUISITION MODULE PN 408134/411166/417120

General 17-2
Safety 17-2
Assembly Configurations 17-2

Exploded View PN 418134-001A/002A 17-3

Schematic Diagram PN 408134-001A/002A 17-4

Parts List PN 408134-001A/002A 17-5

Exploded View PN 411166-001B 17-6

Schematic Diagram PN 411166-001B 17-7

Parts List PN 411166-001B 17-8

Exploded View PN 417120-001B 17-9

Schematic Diagram PN 417120-001B 17-10

Parts List PN 417120-001B 17-11

General

Safety

Observe the following warning:

WARNING
The DAS module contains the isolation barrier between the patient and the rest of the module. If the data acquisition module is removed, repaired, or replaced for any reason, the module must undergo the current leakage and hi-pot tests listed in Chapter 5: “Preventive Maintenance” before being used on a patient. These tests verify the integrity of the isolation barrier, and are necessary to ensure continued safe operation. Failure to perform the tests may cause undue equipment failure and possible health hazards.

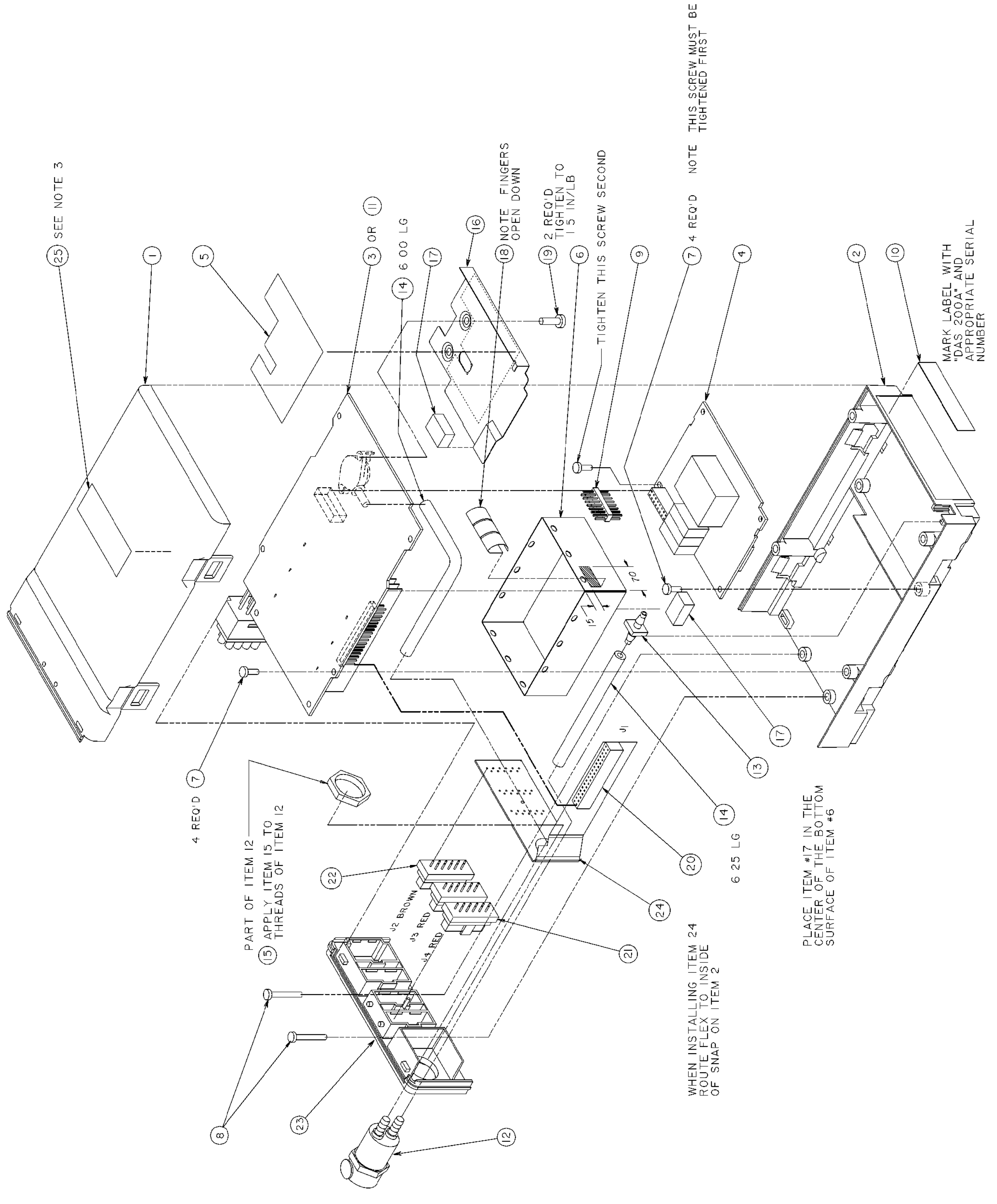
Assembly Configurations

There are four configurations of the DAS module described in this chapter. The difference between the assemblies is in the number of ECG leadwires monitored and the acquisition processor PCB used in the DAS module itself. Use the table below to determine which parts lists to use in this manual for your Tram module.

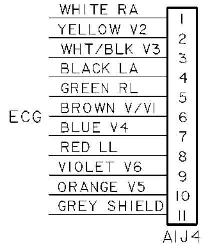
Table 17-1. DAS Module Configurations

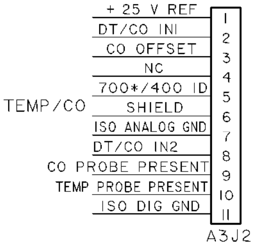
Module Type	Leadwire Configuration	Acquisition Module	Acquisition Processor PCB
Tram 100A	5-Leadwire	408134-001	800330-005
Tram 200A	5-Leadwire	408134-002	800330-006
Tram 200SL	10-Leadwire	411166-001	800330-006
Tram 200SL	10-Leadwire	417120-001 (Replaced 411166-001)	801040-001
Tram 250SL	10-Leadwire	411166-001	800330-006
Tram 250SL	10-Leadwire	417120-001 (Replaced 411166-001)	801040-001

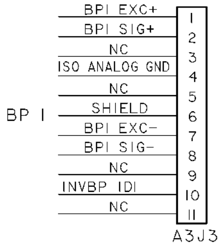
Exploded View PN 418134-001A/002A

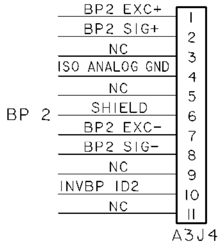

25 SEE NOTE 3
1
5
3 OR 11
14 6.00 LG
17
16
18 NOTE FINGERS OPEN DOWN
19 2 REQ'D TIGHTEN TO 1.5 IN/LB
6
TIGHTEN THIS SCREW SECOND
9
7 4 REQ'D NOTE THIS SCREW MUST BE TIGHTENED FIRST
4
2
10
MARK LABEL WITH "DAS 200A" AND APPROPRIATE SERIAL NUMBER
.70
.15
J1
7 4 REQ'D
PART OF ITEM 12
15 APPLY ITEM 15 TO THREADS OF ITEM 12
22
J2 BROWN
J3 RED
J4 RED
21
24
20
14 6.25 LG
13
17
PLACE ITEM #17 IN THE CENTER OF THE BOTTOM SURFACE OF ITEM #6
WHEN INSTALLING ITEM 24 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
8
23
12

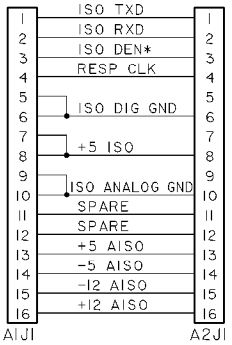
Schematic Diagram PN 408134-001A/002A

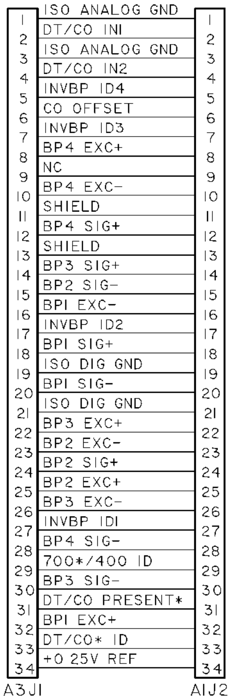

ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/V1
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
1
2
3
4
5
6
7
8
9
10
11
A1J4

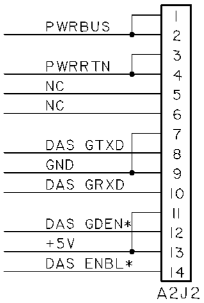

TEMP/CO
+ 25 V REF
DT/CO IN1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
1
2
3
4
5
6
7
8
9
10
11
A3J2

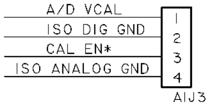

BP 1
BP1 EXC+
BP1 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP1 EXC-
BP1 SIG-
NC
INVBP ID1
NC
1
2
3
4
5
6
7
8
9
10
11
A3J3

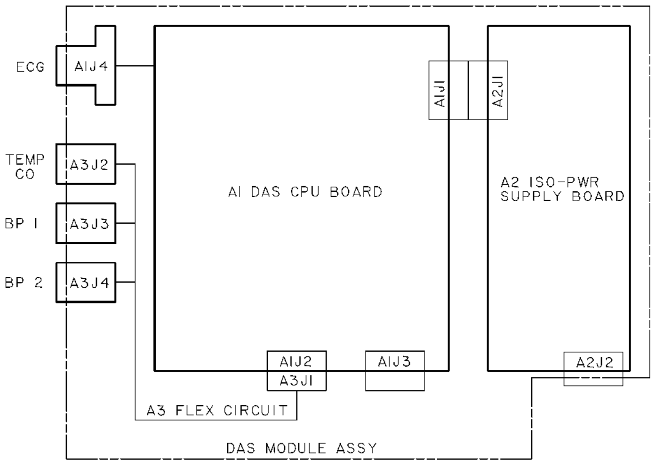

BP 2
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
1
2
3
4
5
6
7
8
9
10
11
A3J4

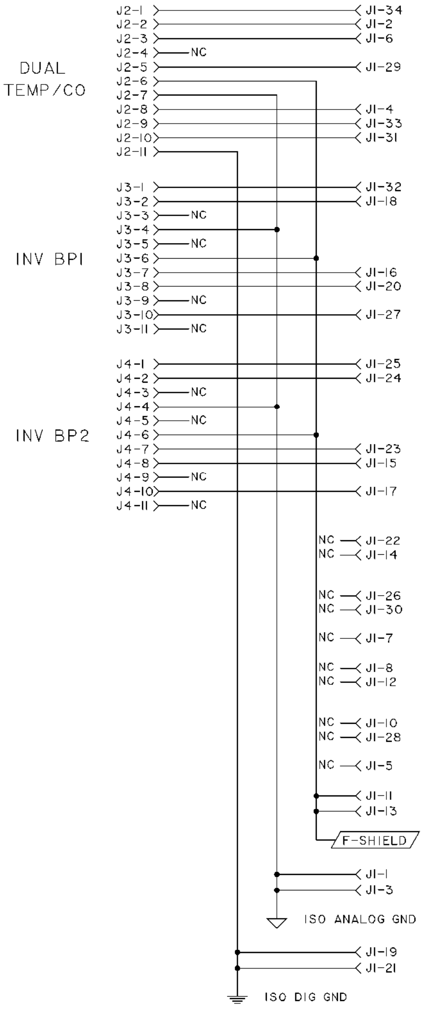

ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
A1J1
A2J1


ISO ANALOG GND
DT/CO IN1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
A3J1
A1J2


PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
1
2
3
4
5
6
7
8
9
10
11
12
13
14
A2J2


A/D VCAL
ISO DIG GND
CAL EN*
ISO ANALOG GND
1
2
3
4
A1J3


ECG
A1J4
TEMP
CO
A3J2
BP 1
A3J3
BP 2
A3J4
A1 DAS CPU BOARD
A1J1
A2J1
A2 ISO-PWR
SUPPLY BOARD
A1J2
A3J1
A1J3
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY

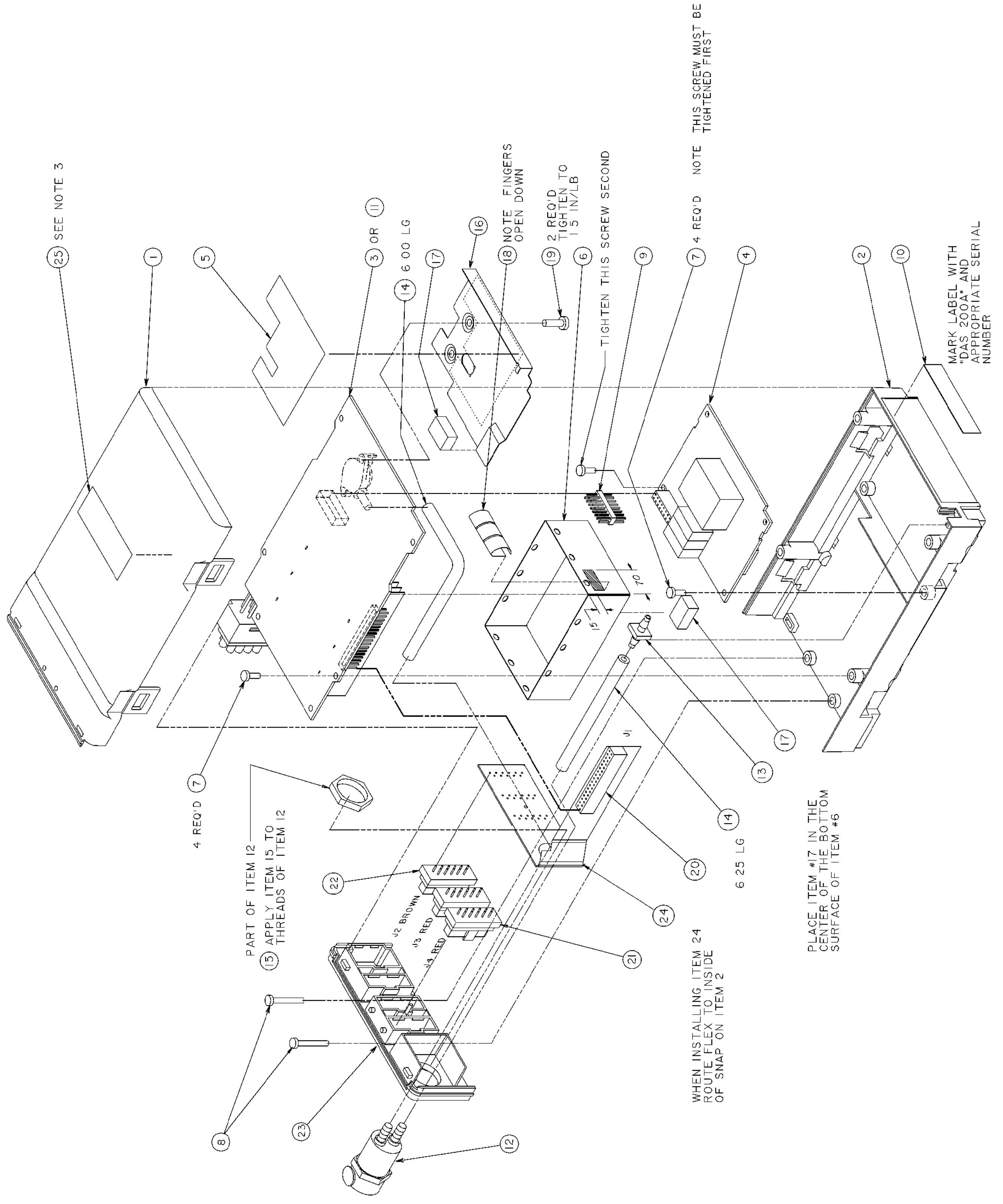

DUAL
TEMP/CO
J2-1
J2-2
J2-3
J2-4
J2-5
J2-6
J2-7
J2-8
J2-9
J2-10
J2-11
NC
J1-34
J1-2
J1-6
J1-29
J1-4
J1-33
J1-31
INV BP1
J3-1
J3-2
J3-3
J3-4
J3-5
J3-6
J3-7
J3-8
J3-9
J3-10
J3-11
NC
NC
NC
NC
J1-32
J1-18
J1-16
J1-20
J1-27
INV BP2
J4-1
J4-2
J4-3
J4-4
J4-5
J4-6
J4-7
J4-8
J4-9
J4-10
J4-11
NC
NC
NC
NC
J1-25
J1-24
J1-23
J1-15
J1-17
NC J1-22
NC J1-14
NC J1-26
NC J1-30
NC J1-7
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GND
J1-19
J1-21
ISO DIG GND

FLEX CIRCUIT SCHEMATIC

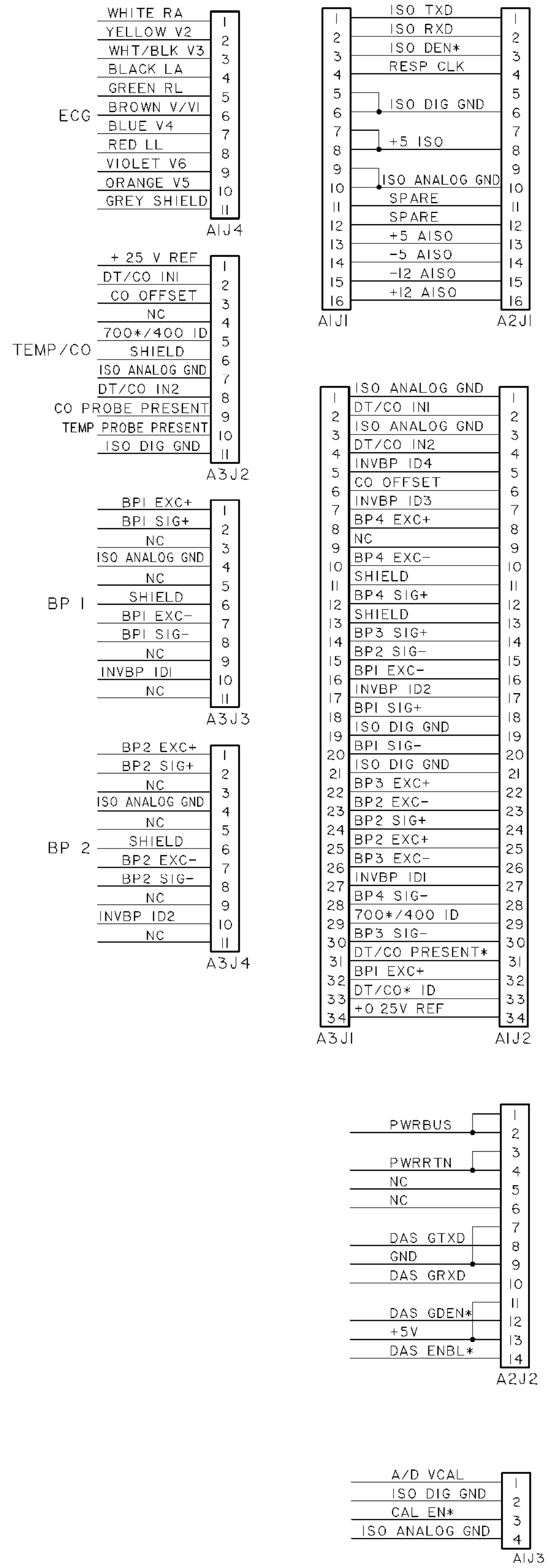
Parts List PN 408134-001A/002A

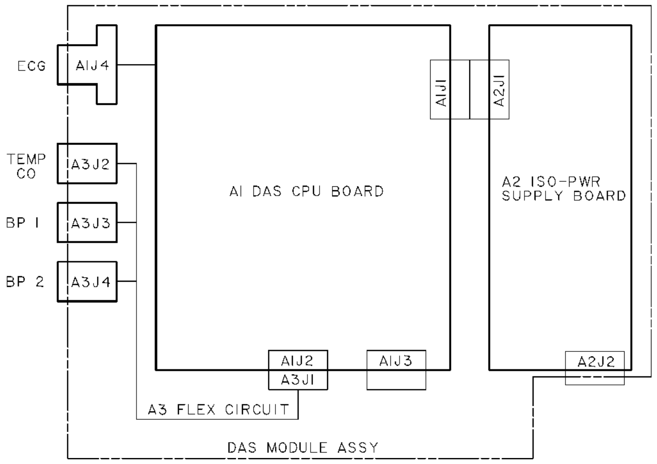
Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Top	401311-001	1
2		Cover, Lower	401681-001	1
3	A1	Acquisition Processor PCB, 5-Lead, 2-BP, W/NBP (For PN 408134-001 Only)	800330-005	1
4	A2	Isolated Power Supply PCB	402329-002	1
5		Insulator	408417-001	1
6		Shield, Hybrids	403283-002	1
7		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
8		Screw, 4-40 x 7/8	404069-001	2
9	A1J1, A2J1	Header, Vertical, 16-Pin	1778-916	1
10		Label, Model/Serial Number	404525-006	1
11	A1	Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP (For PN 408134-002 Only)	800330-006	1
12		Connector, Pneumatic, NBP	401184-001	1
13		Connector, Pneumatic	404445-001	1
14		Tubing, Silastic	401582-001	AR
15		Adhesive, Permabond 910FS	4851-074	AR
16		Shield, Acquisition Processor PCB, Lower	405517-001	1
17		Tape, Foam	4819-102	AR
18		Spring, Chassis Ground, Rear	403741-001	AR
19		Screw, BDGH, Phillips, 6-32 x 7/16	45074-918	2
20	A3J1	Connector, 34-Pin, Horizontal	17020-034	1
21	A3J3, A3J4	Connector, BP (Red)	401762-004	2
22	A3J2	Connector, TEMP/CO (Brown)	401762-021	1
23		Isolated Connector Panel, Tram 100/200	402159-002	1
24	A3	Flex Circuit, BP/Temp	404109-002	1
25		Label (Marked with “WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED”)	404525-001	1

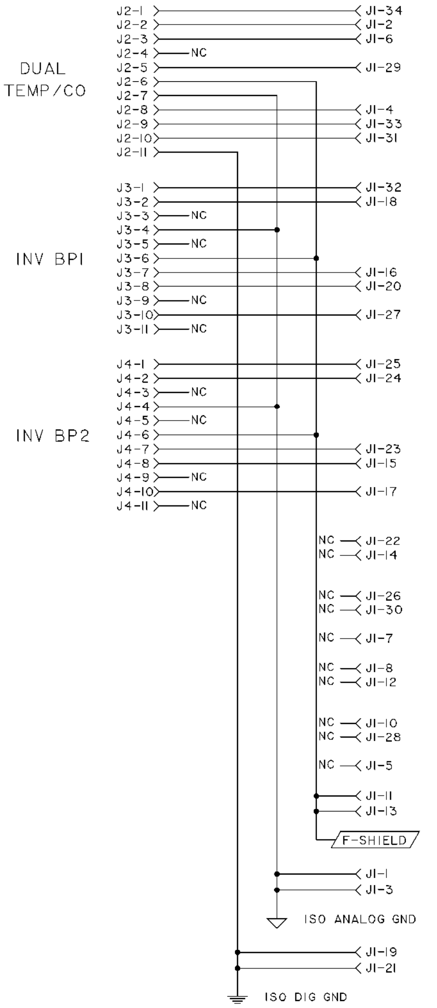
Exploded View PN 411166-001B


25 SEE NOTE 3
1
5
3 OR 11
14 6.00 LG
17
16
18 NOTE FINGERS OPEN DOWN
19 2 REQ'D TIGHTEN TO 1.5 IN/LB
6
TIGHTEN THIS SCREW SECOND
9
7 4 REQ'D NOTE THIS SCREW MUST BE TIGHTENED FIRST
4
2
10
MARK LABEL WITH "DAS 200A" AND APPROPRIATE SERIAL NUMBER
.70
.15
J1
7 4 REQ'D
PART OF ITEM 12
15 APPLY ITEM 15 TO THREADS OF ITEM 12
22
J2 BROWN
J3 RED
J4 RED
21
24
20
14 6.25 LG
13
17
PLACE ITEM #17 IN THE CENTER OF THE BOTTOM SURFACE OF ITEM #6
WHEN INSTALLING ITEM 24 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
8
23
12

Schematic Diagram PN 411166-001B


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/VI
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A1J4
TEMP/CO
+ 25 V REF
DT/CO IN1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A3J2
BP 1
BP1 EXC+
BP1 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP1 EXC-
BP1 SIG-
NC
INVBP ID1
NC
A3J3
BP 2
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
A3J4
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A1J1
A2J1
ISO ANALOG GND
DT/CO IN1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A3J1
A1J2
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A2J2
A/D VCAL
ISO DIG GND
CAL EN*
ISO ANALOG GND
A1J3


ECG
A1J4
TEMP CO
A3J2
BP 1
A3J3
BP 2
A3J4
A1 DAS CPU BOARD
A1J1
A2J1
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A1J3
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY

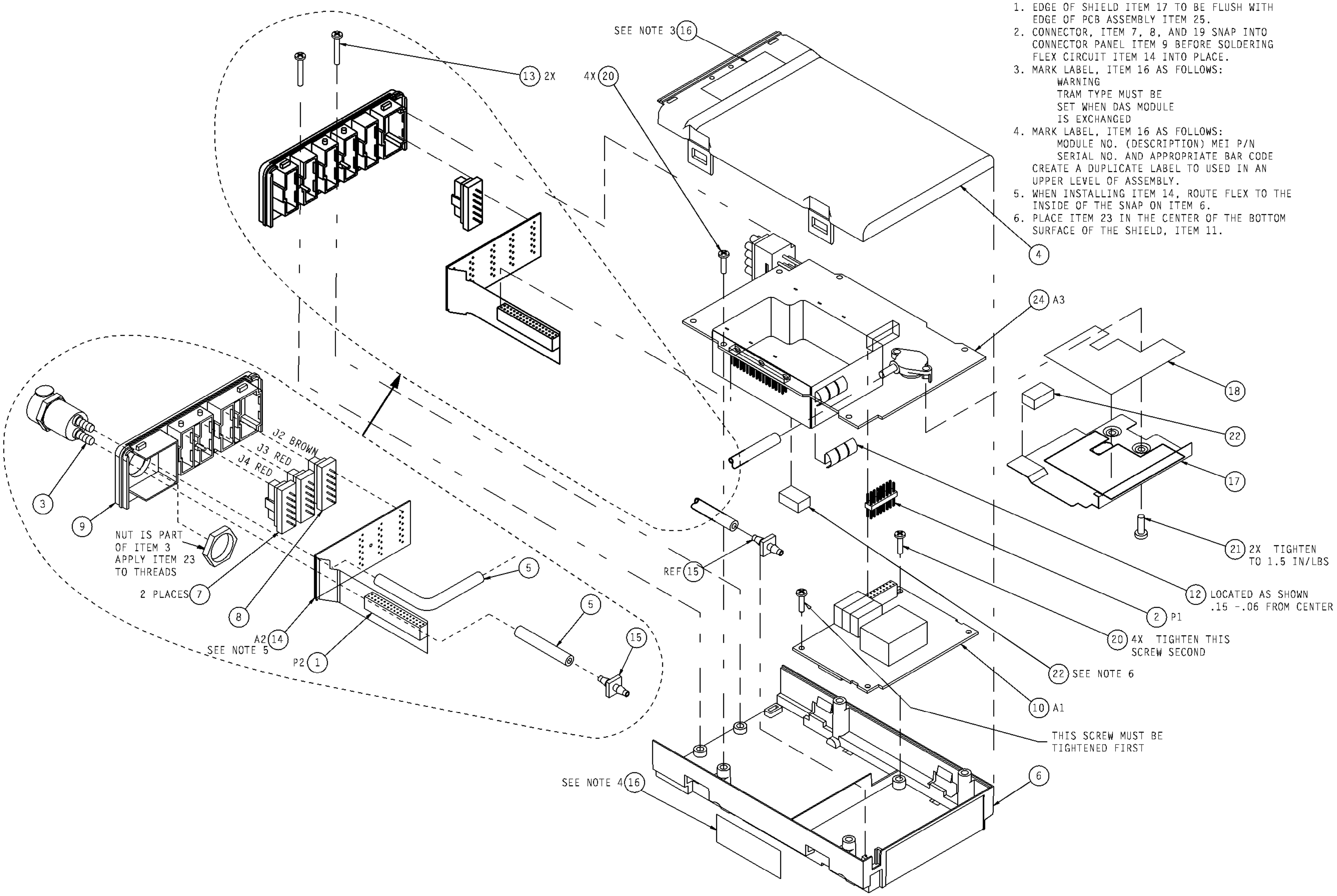

DUAL TEMP/CO
J2-1
J2-2
J2-3
J2-4
J2-5
J2-6
J2-7
J2-8
J2-9
J2-10
J2-11
INV BP1
J3-1
J3-2
J3-3
J3-4
J3-5
J3-6
J3-7
J3-8
J3-9
J3-10
J3-11
INV BP2
J4-1
J4-2
J4-3
J4-4
J4-5
J4-6
J4-7
J4-8
J4-9
J4-10
J4-11
NC
J1-34
J1-2
J1-6
J1-29
J1-4
J1-33
J1-31
J1-32
J1-18
J1-16
J1-20
J1-27
J1-25
J1-24
J1-23
J1-15
J1-17
J1-22
J1-14
J1-26
J1-30
J1-7
J1-8
J1-12
J1-10
J1-28
J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GND
J1-19
J1-21
ISO DIG GND

FLEX CIRCUIT SCHEMATIC

Parts List PN 411166-001B

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Top	401311-001	0
2		Cover, Lower	401681-001	0
3	A1	Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP	800330-006	1
4	A2	Isolated Power Supply PCB	402329-002	1
5		Insulator	408417-001	1
7		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
8		Screw, 4-40 x 7/8	404069-001	2
9		Header, Vertical, 16-Pin	1778-916	1
10		Label (Marked with “WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED”)	404525-001	2
12		Connector, Pneumatic, NBP	401184-001	1
13		Connector, Pneumatic	404445-001	1
14		Tubing, Silastic	401582-001	AR
15		Adhesive, Permabond 910FS	4851-074	AR
16		Shield, Acquisition Processor PCB, Lower	405517-001	1
17		Tape, Foam	4819-102	2
18		Spring, Chassis Ground, Rear	403741-001	AR
19		Screw, BDGH, Phillips, 6-32 x 1/2	45074-917	2
20		Connector, 34-Pin, Horizontal	17020-034	1
21		Connector, BP (Red)	401762-004	2
22		Connector, TEMP/CO (Brown)	401762-021	1
23		Isolated Connector Panel, Tram 100/200	402159-002	1
24	A3	Flex Circuit, BP/Temp	404109-002	1

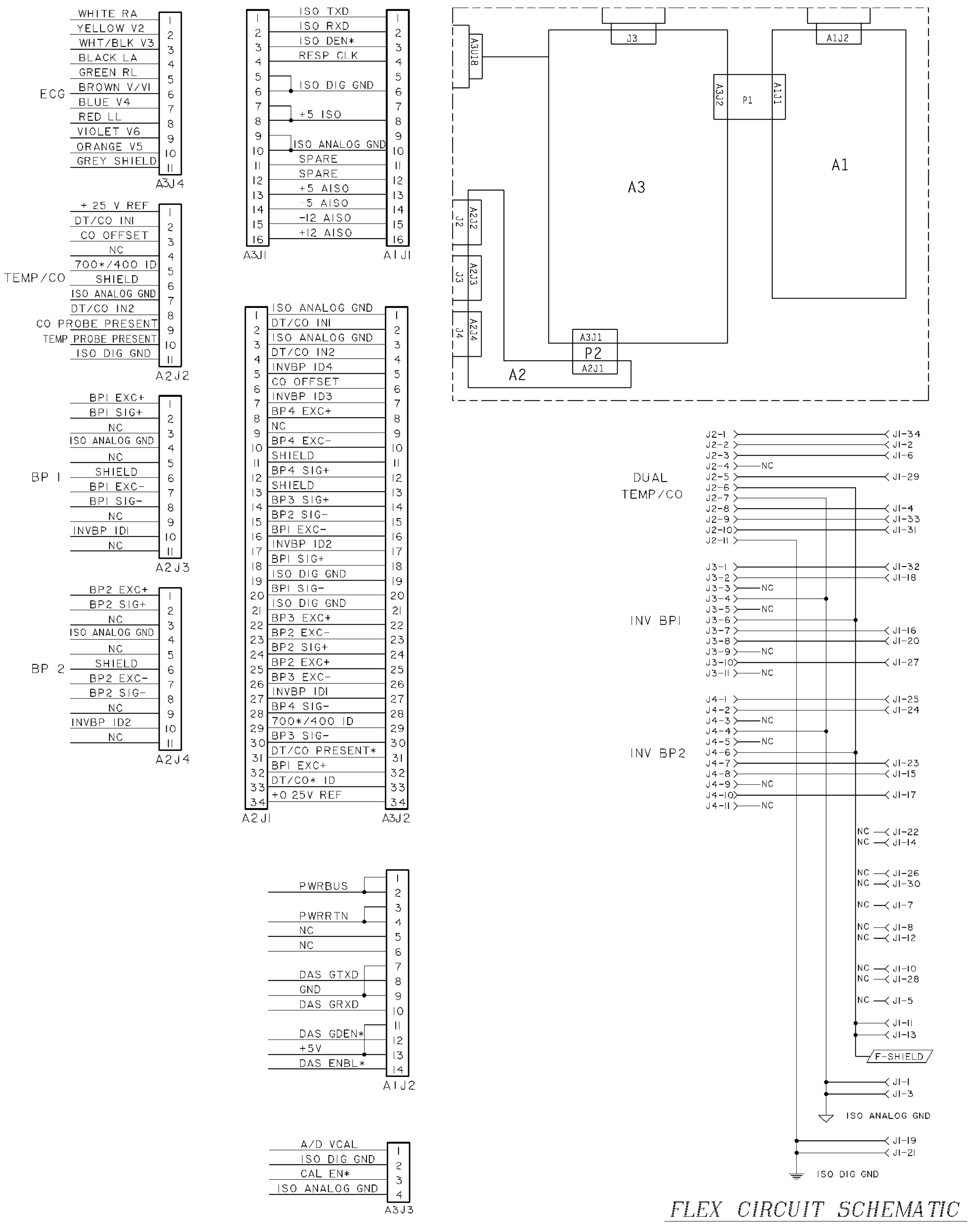
Exploded View PN 417120-001B


SEE NOTE 3 (16)
(13) 2X
4X (20)
(4)
(24) A3
(18)
(22)
(17)
(21) 2X TIGHTEN TO 1.5 IN/LBS
(12) LOCATED AS SHOWN .15 -.06 FROM CENTER
(2) P1
(20) 4X TIGHTEN THIS SCREW SECOND
(22) SEE NOTE 6
(10) A1
THIS SCREW MUST BE TIGHTENED FIRST
(6)
SEE NOTE 4 (16)
REF (15)
J2 BROWN
J3 RED
J4 RED
(3)
(9)
NUT IS PART OF ITEM 3 APPLY ITEM 23 TO THREADS
2 PLACES (7)
(8)
(5)
(5)
(15)
A2 (14) SEE NOTE 5
P2 (1)

NOTES:

1. EDGE OF SHIELD ITEM 17 TO BE FLUSH WITH EDGE OF PCB ASSEMBLY ITEM 25.
2. CONNECTOR, ITEM 7, 8, AND 19 SNAP INTO CONNECTOR PANEL ITEM 9 BEFORE SOLDERING FLEX CIRCUIT ITEM 14 INTO PLACE.
3. MARK LABEL, ITEM 16 AS FOLLOWS:
    WARNING
    TRAM TYPE MUST BE
    SET WHEN DAS MODULE
    IS EXCHANGED
4. MARK LABEL, ITEM 16 AS FOLLOWS:
    MODULE NO. (DESCRIPTION) MEI P/N
    SERIAL NO. AND APPROPRIATE BAR CODE
   CREATE A DUPLICATE LABEL TO USED IN AN UPPER LEVEL OF ASSEMBLY.
5. WHEN INSTALLING ITEM 14, ROUTE FLEX TO THE INSIDE OF THE SNAP ON ITEM 6.
6. PLACE ITEM 23 IN THE CENTER OF THE BOTTOM SURFACE OF THE SHIELD, ITEM 11.

Schematic Diagram PN 417120-001B


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/V1
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A3J4
TEMP/CO
+ 25 V REF
DT/CO IN1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A2J2
BP 1
BP1 EXC+
BP1 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP1 EXC-
BP1 SIG-
NC
INVBP ID1
NC
A2J3
BP 2
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
A2J4
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A3J1
A1J1
ISO ANALOG GND
DT/CO IN1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A2J1
A3J2
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A1J2
A/D VCAL
ISO DIG GND
CAL EN*
ISO ANALOG GND
A3J3
A3U18
J3
A1J2
A3J2
P1
A1J1
A1
A3
A2J2
J2
A2J3
J3
A2J4
J4
A3J1
P2
A2J1
A2
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
INV BP1
J3-1 J1-32
J3-2 J1-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 J1-16
J3-8 J1-20
J3-9 NC
J3-10 J1-27
J3-11 NC
INV BP2
J4-1 J1-25
J4-2 J1-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 J1-23
J4-8 J1-15
J4-9 NC
J4-10 J1-17
J4-11 NC
NC J1-22
NC J1-14
NC J1-26
NC J1-30
NC J1-7
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GND
J1-19
J1-21
ISO DIG GND
FLEX CIRCUIT SCHEMATIC

Parts List PN 417120-001B

Item	Reference Designation	Parts List	Part Number	Qty
1	P2	Connector, 34-Pin, Horizontal	17020-034	1
2	P1	Header, Vertical, 16-Pin	1778-916	1
3		Connector, Pneumatic, NBP	401184-001	1
4		Cover, Top	401311-001	1
5		Tubing, Silastic	401582-001	AR
6		Cover, Lower	401681-001	1
7		Connector, BP (Red)	401762-004	2
8		Connector, TEMP/CO (Brown)	401762-021	1
9		Isolated Connector Panel, Tram 100/200	402159-002	1
10	A1	Isolated Power Supply PCB	402329-002	1
12		Spring, Chassis Ground, Rear	403741-001	AR
13		Screw, 4-40 x 7/8	404069-001	2
14	A2	Flex Circuit, BP/Temp	404109-002	1
15		Connector, Pneumatic	404445-001	1
16		Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED")	404525-001	2
17		Shield, Acquisition Processor PCB, Lower	405517-001	1
18		Insulator	408417-001	1
20		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
21		Screw, BDGH, Phillips, 6-32 x 1/2	45074-917	2
22		Tape, Foam	4819-102	2
23		Adhesive, Permabond 910FS	4851-074	AR
24	A3	Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP	801040-001	1

For your notes

18

400 ACQUISITION MODULE PN 410495/411167/417121

General **18-2**

Safety 18-2

Assembly Configurations 18-2

Exploded View PN 410495-001D **18-3**

Schematic Diagram PN 410495-001D **18-4**

Module Parts List PN 410495-001D **18-5**

Exploded View PN 411167-001C **18-6**

Schematic Diagram PN 411167-001C **18-7**

Parts List PN 411167-001C **18-8**

Exploded View PN 417121-001B **18-9**

Schematic Diagram PN 417121-001B **18-10**

Parts List PN 417121-001B **18-11**

General

Safety

Observe the following warning:

WARNING
The data acquisition module contains the isolation barrier between the patient and the rest of the module. If the data acquisition module is removed, repaired, or replaced for any reason, the module must undergo the current leakage and hi-pot tests listed in Chapter 5: "Preventive Maintenance" before being used on a patient. These tests verify the integrity of the isolation barrier, and are necessary to ensure continued safe operation. Failure to perform the tests may cause undue equipment failure and possible health hazards.

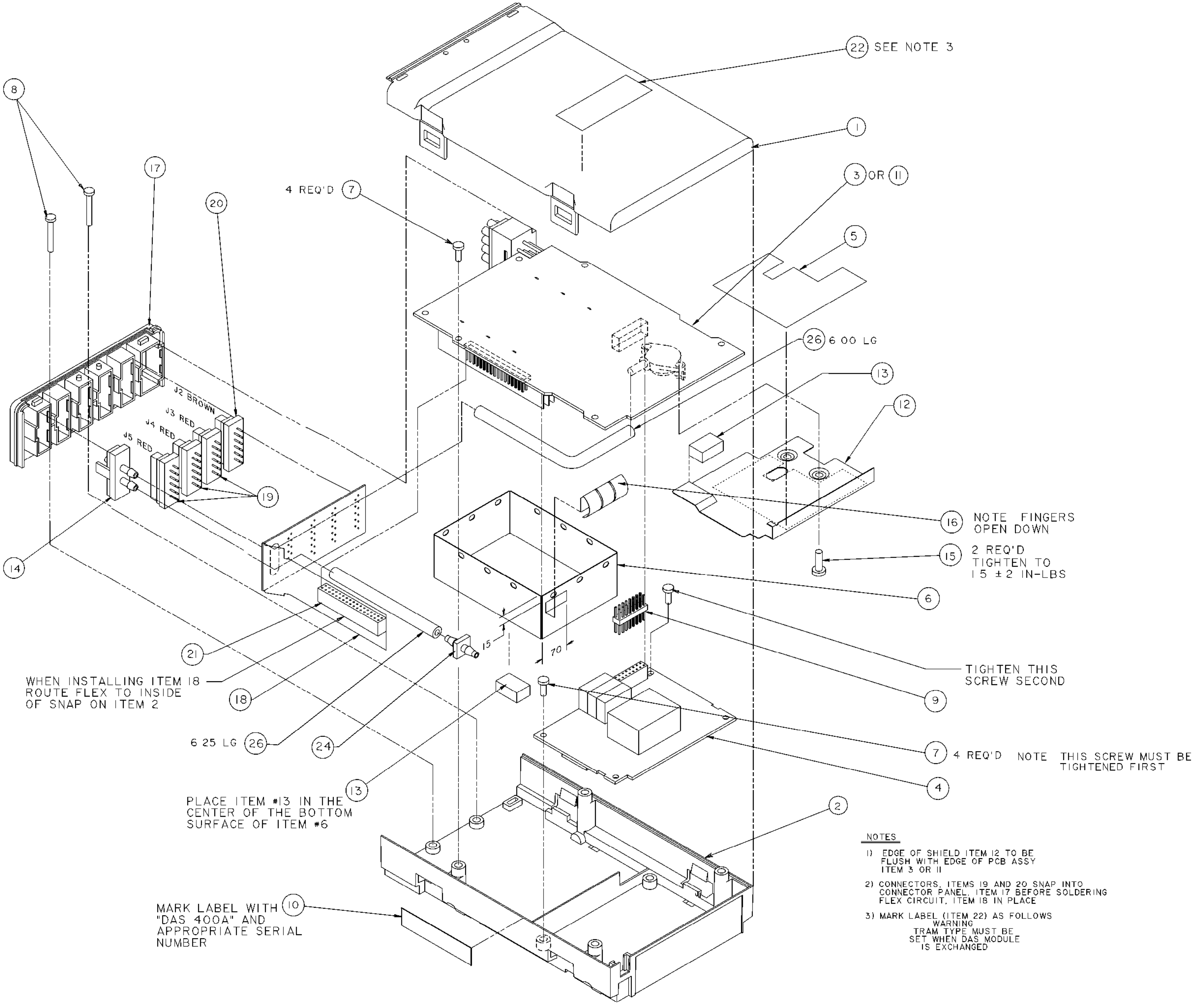
Assembly Configurations

There are three configurations of the data acquisition module described in this chapter. The difference between the assemblies is in the number of ECG leadwires monitored and the acquisition processor PCB used in the DAS module itself. Use the table below to determine which parts lists to use in this manual for your Tram module.

Table 18-1. DAS Module Configurations

Module Type	Leadwire Configuration	DAS Module	Acquisition Processor PCB
Tram 400A	5-Leadwire	410495-001	800330-009
Tram 400SL	10-Leadwire	411167-001	800330-010
Tram 400SL	10-Leadwire	417121-001 (Replaced 411167-001)	801040-001
Tram 450SL	10-Leadwire	411167-001	800330-010
Tram 450SL	10-Leadwire	417121-001 (Replaced 411167-001)	801040-001

Exploded View PN 410495-001D


22 SEE NOTE 3
1
3 OR 11
5
26 6 00 LG
13
12
16 NOTE FINGERS OPEN DOWN
15 2 REQ'D TIGHTEN TO 15 ±2 IN-LBS
6
TIGHTEN THIS SCREW SECOND
9
7 4 REQ'D NOTE THIS SCREW MUST BE TIGHTENED FIRST
4
2
4 REQ'D 7
8
17
20
J2 BROWN
J3 RED
J4 RED
J5 RED
19
14
21
WHEN INSTALLING ITEM 18 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
18
6 25 LG 26
24
15
70
PLACE ITEM #13 IN THE CENTER OF THE BOTTOM SURFACE OF ITEM #6
13
MARK LABEL WITH "DAS 400A" AND APPROPRIATE SERIAL NUMBER
10

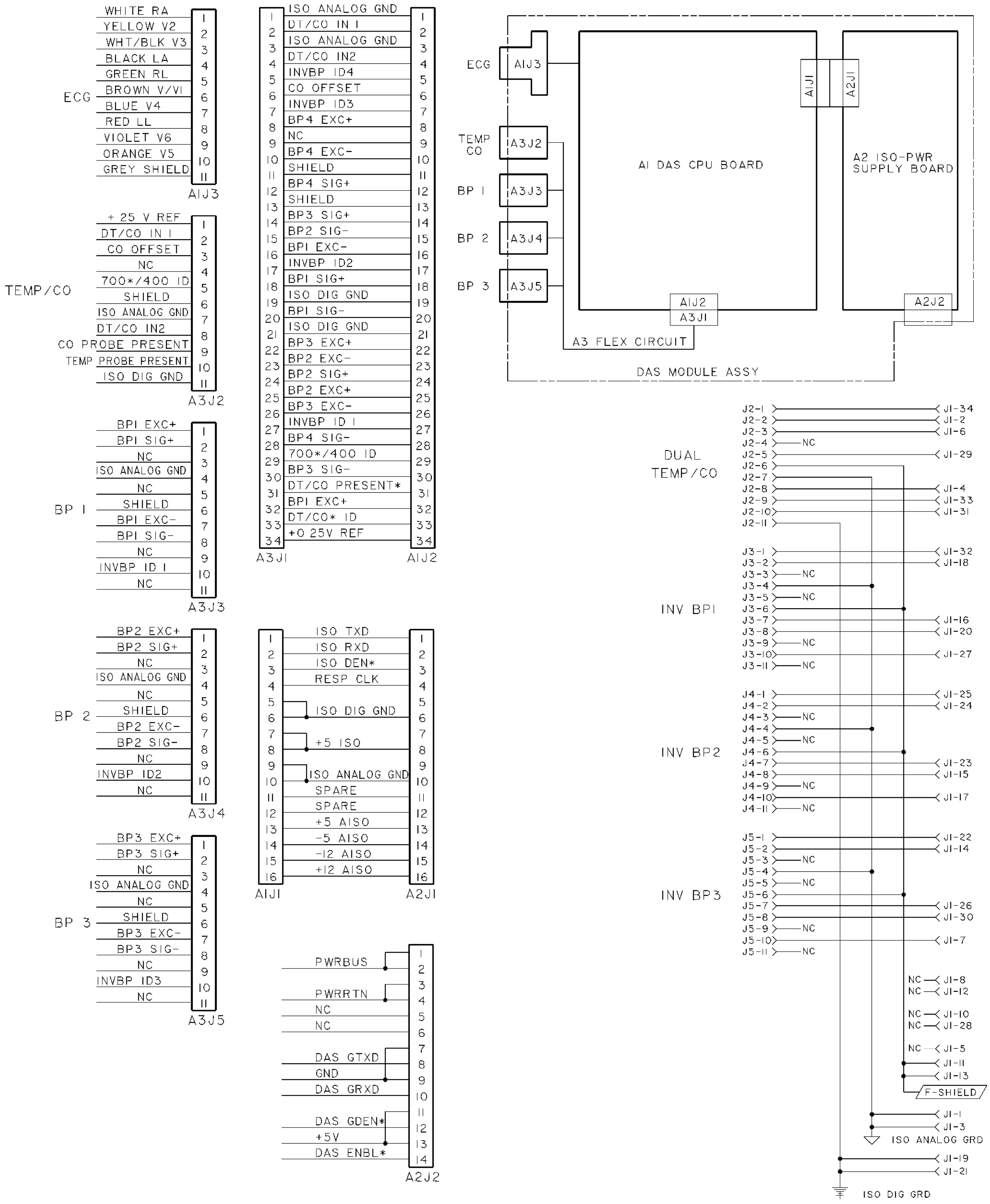
NOTES

1) EDGE OF SHIELD ITEM 12 TO BE FLUSH WITH EDGE OF PCB ASSY ITEM 3 OR 11

2) CONNECTORS, ITEMS 19 AND 20 SNAP INTO CONNECTOR PANEL, ITEM 17 BEFORE SOLDERING FLEX CIRCUIT, ITEM 18 IN PLACE

3) MARK LABEL (ITEM 22) AS FOLLOWS
WARNING
TRAM TYPE MUST BE
SET WHEN DAS MODULE
IS EXCHANGED

Schematic Diagram PN 410495-001D


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/V1
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A1J3
TEMP/CO
+ 25 V REF
DT/CO IN 1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A3J2
BP 1
BP1 EXC+
BP1 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP1 EXC-
BP1 SIG-
NC
INVBP ID 1
NC
A3J3
BP 2
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
A3J4
BP 3
BP3 EXC+
BP3 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP3 EXC-
BP3 SIG-
NC
INVBP ID3
NC
A3J5
ISO ANALOG GND
DT/CO IN 1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID 1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A3J1
A1J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A1J1
A2J1
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A2J2
ECG
A1J3
TEMP CO
A3J2
BP 1
A3J3
BP 2
A3J4
BP 3
A3J5
A1J1
A2J1
A1 DAS CPU BOARD
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
INV BP1
J3-1 J1-32
J3-2 J1-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 J1-16
J3-8 J1-20
J3-9 NC
J3-10 J1-27
J3-11 NC
INV BP2
J4-1 J1-25
J4-2 J1-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 J1-23
J4-8 J1-15
J4-9 NC
J4-10 J1-17
J4-11 NC
INV BP3
J5-1 J1-22
J5-2 J1-14
J5-3 NC
J5-4
J5-5 NC
J5-6
J5-7 J1-26
J5-8 J1-30
J5-9 NC
J5-10 J1-7
J5-11 NC
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

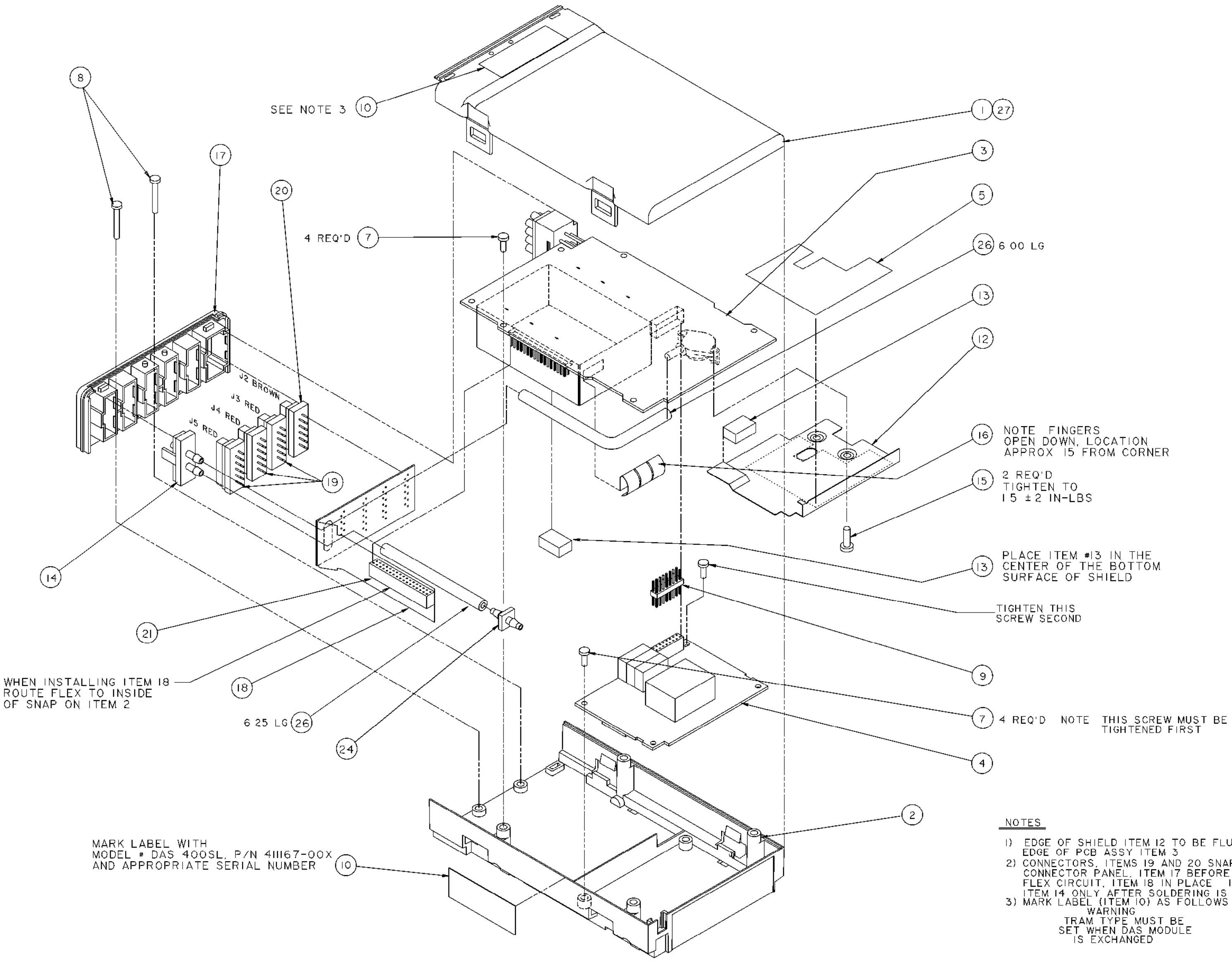
FLEX CIRCUIT SCHEMATIC

ITEM 18

Module Parts List PN 410495-001D

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Top	401311-001	1
2		Cover, Lower	401681-001	1
3	A1	Acquisition Processor PCB, 5-Lead, 3-BP, W/NBP	800330-009	1
4	A2	Isolated Power Supply PCB	402329-002	1
5		Insulator	408417-001	1
6		Shield, Hybrids	403283-002	1
7		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
8		Screw, 4-40 x 7/8	404069-001	2
9	A1J1, A2J1	Header, Vertical, 16-Pin	1778-916	1
10		Label, Model/Serial Number	404525-006	1
12		Shield, Acquisition Processor PCB, Lower	405517-001	1
13		Tape, Foam	4819-102	AR
14		NBP Connector Socket	414640-002	
15		Screw, BDGH, Phillips, 6-32 x 7/16	45074-918	2
16		Spring, Chassis Ground, Rear	403741-001	AR
17		Isolated Connector Panel, Tram 400/500/600 Module	402159-001	1
18	A3	Flex Circuit, BP/Temp	800397-002	1
19	A3J3, A3J4, A3J5	Connector, BP (Red)	401762-004	3
20	A3J2	Connector, TEMP/CO (Brown)	401762-021	1
21	A3J1	Connector, 34-Pin, Horizontal	17020-034	1
22		Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED")	404525-001	1
24		Connector, Pneumatic	404445-001	1
25		Fitting, Adapter, 10-32 to 1/8-Inch ID	4745-201	2
26		Tubing, Silastic	401582-001	AR

Exploded View PN 411167-001C

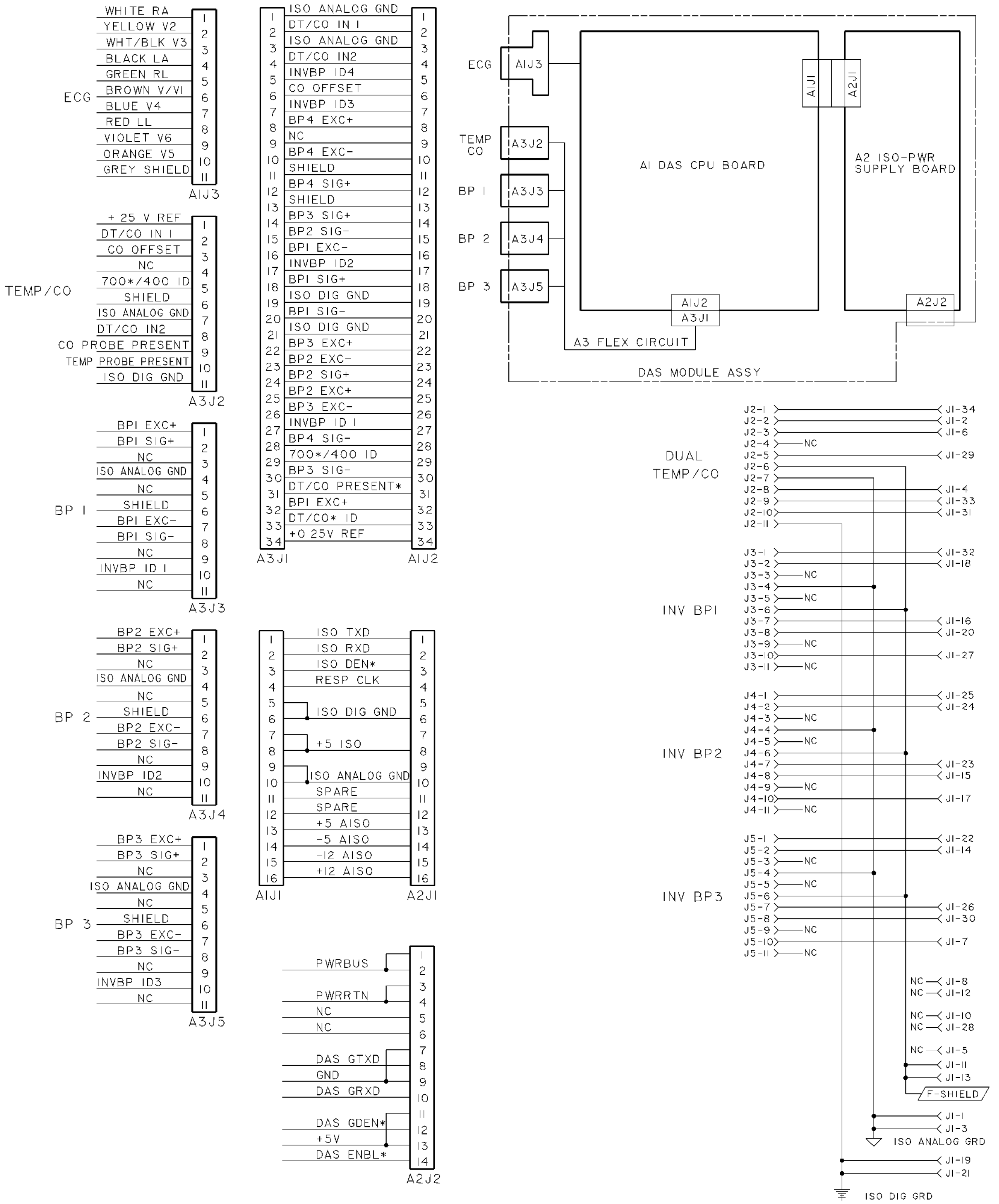

8
17
20
SEE NOTE 3 10
1 27
3
5
4 REQ'D 7
26 6 00 LG
13
12
J2 BROWN
J3 RED
J4 RED
J5 RED
19
16 NOTE FINGERS OPEN DOWN, LOCATION APPROX 15 FROM CORNER
15 2 REQ'D TIGHTEN TO 15 ±2 IN-LBS
14
13 PLACE ITEM #13 IN THE CENTER OF THE BOTTOM SURFACE OF SHIELD
TIGHTEN THIS SCREW SECOND
21
9
WHEN INSTALLING ITEM 18 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
18
6 25 LG 26
7 4 REQ'D NOTE THIS SCREW MUST BE TIGHTENED FIRST
24
4
2
MARK LABEL WITH MODEL # DAS 400SL, P/N 411167-00X AND APPROPRIATE SERIAL NUMBER 10

NOTES

1) EDGE OF SHIELD ITEM 12 TO BE FLUSH WITH EDGE OF PCB ASSY ITEM 3
2) CONNECTORS, ITEMS 19 AND 20 SNAP INTO CONNECTOR PANEL, ITEM 17 BEFORE SOLDERING FLEX CIRCUIT, ITEM 18 IN PLACE. INSTALL ITEM 14 ONLY AFTER SOLDERING IS COMPLETE
3) MARK LABEL (ITEM 10) AS FOLLOWS

WARNING
TRAM TYPE MUST BE
SET WHEN DAS MODULE
IS EXCHANGED

Schematic Diagram PN 411167-001C


ECG
WHITE RA 1
YELLOW V2 2
WHT/BLK V3 3
BLACK LA 4
GREEN RL 5
BROWN V/VI 6
BLUE V4 7
RED LL 8
VIOLET V6 9
ORANGE V5 10
GREY SHIELD 11
A1J3
TEMP/CO
+25 V REF 1
DT/CO IN I 2
CO OFFSET 3
NC 4
700*/400 ID 5
SHIELD 6
ISO ANALOG GND 7
DT/CO IN2 8
CO PROBE PRESENT 9
TEMP PROBE PRESENT 10
ISO DIG GND 11
A3J2
BP 1
BP1 EXC+ 1
BP1 SIG+ 2
NC 3
ISO ANALOG GND 4
NC 5
SHIELD 6
BP1 EXC- 7
BP1 SIG- 8
NC 9
INVBP ID 1 10
NC 11
A3J3
BP 2
BP2 EXC+ 1
BP2 SIG+ 2
NC 3
ISO ANALOG GND 4
NC 5
SHIELD 6
BP2 EXC- 7
BP2 SIG- 8
NC 9
INVBP ID2 10
NC 11
A3J4
BP 3
BP3 EXC+ 1
BP3 SIG+ 2
NC 3
ISO ANALOG GND 4
NC 5
SHIELD 6
BP3 EXC- 7
BP3 SIG- 8
NC 9
INVBP ID3 10
NC 11
A3J5
1 ISO ANALOG GND 1
2 DT/CO IN 1 2
3 ISO ANALOG GND 3
4 DT/CO IN2 4
5 INVBP ID4 5
6 CO OFFSET 6
7 INVBP ID3 7
8 BP4 EXC+ 8
9 NC 9
10 BP4 EXC- 10
11 SHIELD 11
12 BP4 SIG+ 12
13 SHIELD 13
14 BP3 SIG+ 14
15 BP2 SIG- 15
16 BP1 EXC- 16
17 INVBP ID2 17
18 BP1 SIG+ 18
19 ISO DIG GND 19
20 BP1 SIG- 20
21 ISO DIG GND 21
22 BP3 EXC+ 22
23 BP2 EXC- 23
24 BP2 SIG+ 24
25 BP2 EXC+ 25
26 BP3 EXC- 26
27 INVBP ID 1 27
28 BP4 SIG- 28
29 700*/400 ID 29
30 BP3 SIG- 30
31 DT/CO PRESENT* 31
32 BP1 EXC+ 32
33 DT/CO* ID 33
34 +0 25V REF 34
A3J1
A1J2
1 ISO TXD 1
2 ISO RXD 2
3 ISO DEN* 3
4 RESP CLK 4
5 6 ISO DIG GND 5 6
7 8 +5 ISO 7 8
9 10 ISO ANALOG GND 9 10
11 SPARE 11
12 SPARE 12
13 +5 AISO 13
14 -5 AISO 14
15 -12 AISO 15
16 +12 AISO 16
A1J1
A2J1
PWRBUS 1 2
PWRRTN 3 4
NC 5
NC 6
DAS GTXD 7
GND 8 9
DAS GRXD 10
DAS GDEN* 11 12
+5V 13
DAS ENBL* 14
A2J2
ECG
A1J3
TEMP CO
A3J2
BP 1
A3J3
BP 2
A3J4
BP 3
A3J5
A1J1
A2J1
A1 DAS CPU BOARD
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
INV BP1
J3-1 J1-32
J3-2 J1-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 J1-16
J3-8 J1-20
J3-9 NC
J3-10 J1-27
J3-11 NC
INV BP2
J4-1 J1-25
J4-2 J1-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 J1-23
J4-8 J1-15
J4-9 NC
J4-10 J1-17
J4-11 NC
INV BP3
J5-1 J1-22
J5-2 J1-14
J5-3 NC
J5-4
J5-5 NC
J5-6
J5-7 J1-26
J5-8 J1-30
J5-9 NC
J5-10 J1-7
J5-11 NC
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

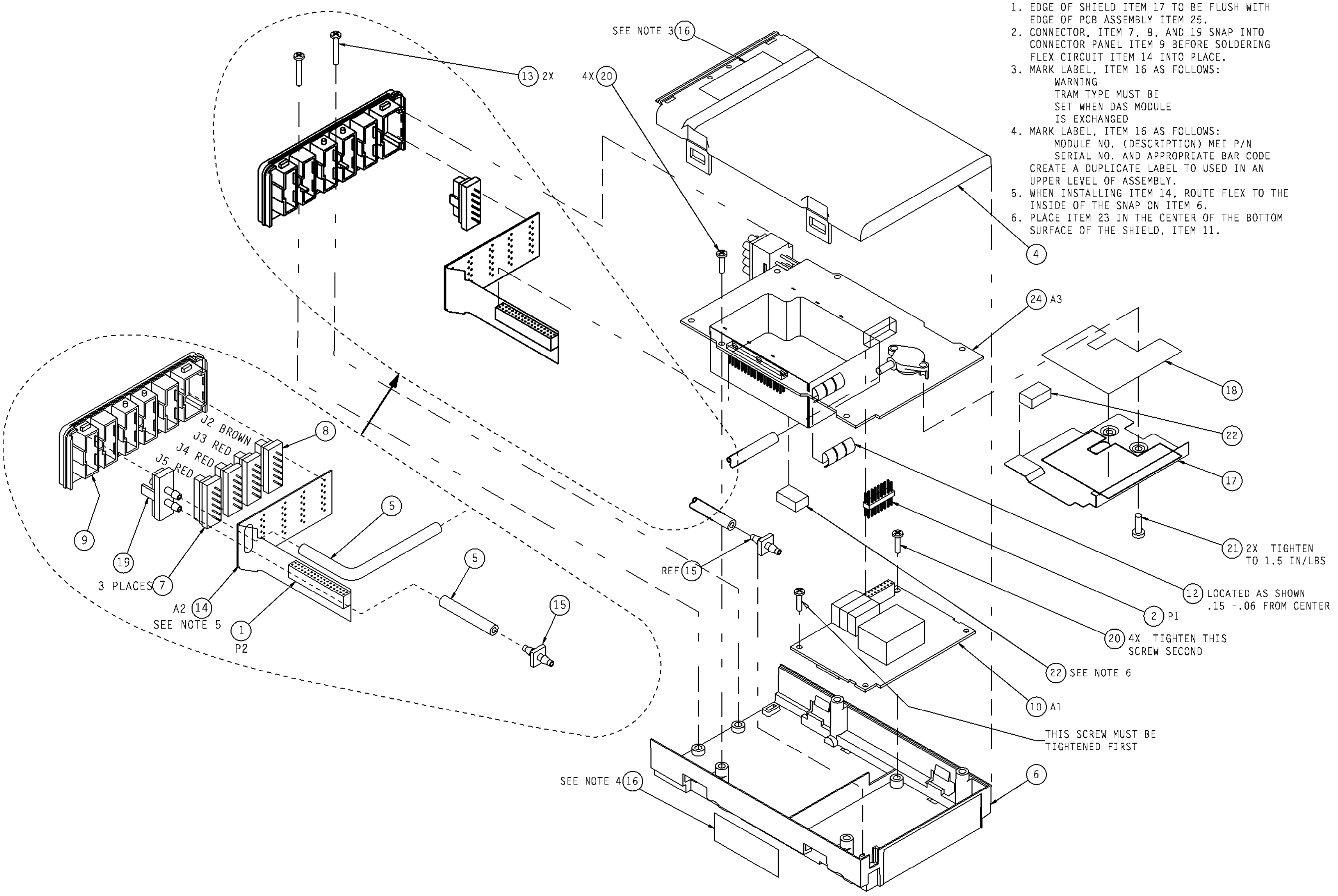
FLEX CIRCUIT SCHEMATIC

ITEM 18

Parts List PN 411167-001C

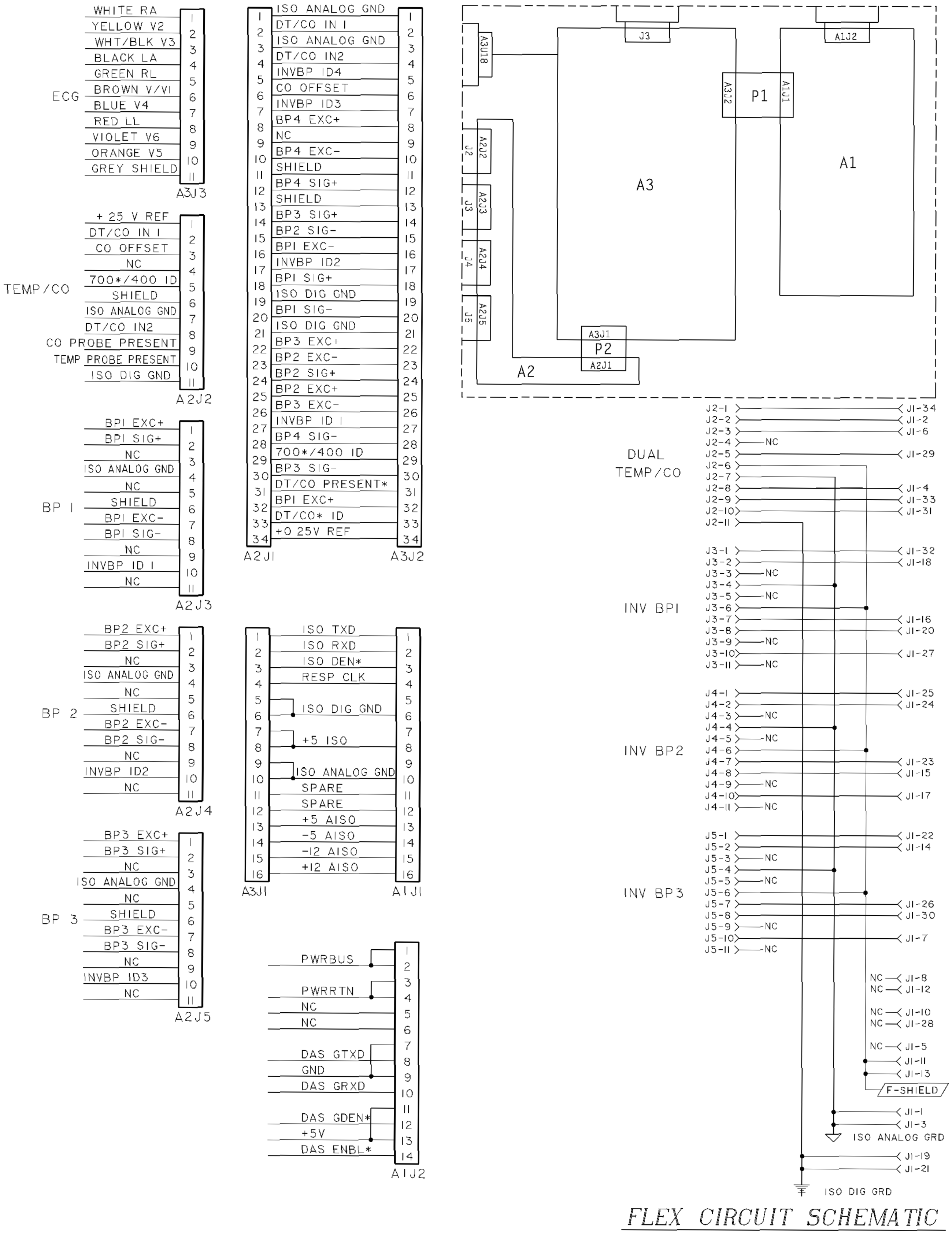
Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Top	401311-001	0
2		Cover, Lower	401681-001	0
3	A1	Acquisition Processor PCB, 10-Lead, 3-BP, W/NBP	800330-010	1
4	A2	Isolated Power Supply PCB	402329-002	1
5		Insulator	408417-001	1
7		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
8		Screw, 4-40 x 7/8	404069-001	2
9		Header, Vertical, 16-Pin	1778-916	1
10		Label (Marked with "WARNING TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED")	404525-001	2
12		Shield, Acquisition Processor PCB, Lower	405517-001	1
13		Tape, Foam	4819-102	2
14		Connector, Pneumatic, NBP, Recessed	409376-002	1
15		Screw, BDGH, Phillips, 6-32 x 1/2	45074-917	2
16		Spring, Chassis Ground, Rear	403741-001	AR
17		Isolated Connector Panel, Tram 400/500/600 Module	402159-001	1
18	A3	Flex Circuit, BP/Temp	800397-002	1
19		Connector, BP (Red)	401762-004	3
20		Connector, TEMP/CO (Brown)	401762-021	1
21		Connector, 34-Pin, Horizontal	17020-034	1
24		Connector, Pneumatic	404445-001	1
26		Tubing, Silastic	401582-001	AR

Exploded View PN 417121-001B


SEE NOTE 3 (16)
4X (20)
(13) 2X
(4)
(24) A3
(18)
(22)
(17)
(21) 2X TIGHTEN TO 1.5 IN/LBS
(12) LOCATED AS SHOWN .15 -.06 FROM CENTER
(2) P1
(20) 4X TIGHTEN THIS SCREW SECOND
(22) SEE NOTE 6
(10) A1
THIS SCREW MUST BE TIGHTENED FIRST
(6)
SEE NOTE 4 (16)
REF (15)
(8)
J2 BROWN
J3 RED
J4 RED
J5 RED
(5)
(5)
(15)
(9)
(19)
3 PLACES (7)
A2 (14)
SEE NOTE 5
(1)
P2

NOTES:
1. EDGE OF SHIELD ITEM 17 TO BE FLUSH WITH EDGE OF PCB ASSEMBLY ITEM 25.
2. CONNECTOR, ITEM 7, 8, AND 19 SNAP INTO CONNECTOR PANEL ITEM 9 BEFORE SOLDERING FLEX CIRCUIT ITEM 14 INTO PLACE.
3. MARK LABEL, ITEM 16 AS FOLLOWS:
    WARNING
    TRAM TYPE MUST BE
    SET WHEN DAS MODULE
    IS EXCHANGED
4. MARK LABEL, ITEM 16 AS FOLLOWS:
    MODULE NO. (DESCRIPTION) MEI P/N
    SERIAL NO. AND APPROPRIATE BAR CODE
   CREATE A DUPLICATE LABEL TO USED IN AN UPPER LEVEL OF ASSEMBLY.
5. WHEN INSTALLING ITEM 14, ROUTE FLEX TO THE INSIDE OF THE SNAP ON ITEM 6.
6. PLACE ITEM 23 IN THE CENTER OF THE BOTTOM SURFACE OF THE SHIELD, ITEM 11.

Schematic Diagram PN 417121-001B



ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/VI
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A3J3
TEMP/CO
+ 25 V REF
DT/CO IN I
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A2J2
BP I
BPI EXC+
BPI SIG+
NC
ISO ANALOG GND
NC
SHIELD
BPI EXC-
BPI SIG-
NC
INVBP ID I
NC
A2J3
BP 2
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
A2J4
BP 3
BP3 EXC+
BP3 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP3 EXC-
BP3 SIG-
NC
INVBP ID3
NC
A2J5
ISO ANALOG GND
DT/CO IN I
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BPI EXC-
INVBP ID2
BPI SIG+
ISO DIG GND
BPI SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID I
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BPI EXC+
DT/CO* ID
+0 25V REF
A2JI
A3J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A3JI
AIJI
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
AIJ2
A3U18
J3
A1J2
A3J2
P1
A1J1
J2
A2J2
J3
A2J3
J4
A2J4
J5
A2J5
A3
A1
A3J1
P2
A2J1
A2
DUAL TEMP/CO
J2-I J2-2 J2-3 J2-4 J2-5 J2-6 J2-7 J2-8 J2-9 J2-10 J2-II
JI-34 JI-2 JI-6 NC JI-29 JI-4 JI-33 JI-31
INV BPI
J3-I J3-2 J3-3 J3-4 J3-5 J3-6 J3-7 J3-8 J3-9 J3-10 J3-II
JI-32 JI-18 NC NC JI-16 JI-20 NC JI-27 NC
INV BP2
J4-I J4-2 J4-3 J4-4 J4-5 J4-6 J4-7 J4-8 J4-9 J4-10 J4-II
JI-25 JI-24 NC NC JI-23 JI-15 NC JI-17 NC
INV BP3
J5-I J5-2 J5-3 J5-4 J5-5 J5-6 J5-7 J5-8 J5-9 J5-10 J5-II
JI-22 JI-14 NC NC JI-26 JI-30 NC JI-7 NC
NC JI-8
NC JI-12
NC JI-10
NC JI-28
NC JI-5
JI-II
JI-13
F-SHIELD
JI-I
JI-3
ISO ANALOG GRD
JI-19
JI-21
ISO DIG GRD

FLEX CIRCUIT SCHEMATIC

Parts List PN 417121-001B

Item	Reference Designation	Parts List	Part Number	Qty
1	P2	Connector, 34-Pin, Horizontal	17020-034	1
2	P1	Header, Vertical, 16-Pin	1778-916	1
4		Cover, Top	401311-001	1
5		Tubing, Silastic	401582-001	AR
6		Cover, Lower	401681-001	1
7		Connector, BP (Red)	401762-004	3
8		Connector, TEMP/CO (Brown)	401762-021	1
9		Isolated Connector Panel, Tram 400/500/600 Module	402159-001	1
10	A1	Isolated Power Supply PCB	402329-002	1
12		Spring, Chassis Ground, Rear	403741-001	AR
13		Screw, 4-40 x 7/8	404069-001	2
14	A2	Flex Circuit, BP/Temp	800397-002	1
15		Connector, Pneumatic	404445-001	1
16		Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED")	404525-001	2
17		Shield, Acquisition Processor PCB, Lower	405517-001	1
18		Insulator	408417-001	1
19		Socket, NBP w/o Key	414640-002	1
20		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
21		Screw, BDGH, Phillips, 6-32 x 1/2	45074-917	2
22		Tape, Foam	4819-102	2
24	A3	Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP	801040-001	1

For your notes

19

500/600 ACQUISITION MODULE PN 408133/411168/417122

General **19-2**
Safety 19-2
Assembly Configurations 19-2

Exploded View PN 408133-001A/002A **19-3**

Schematic Diagram PN 408133-001A/002A **19-4**

Parts List PN 408133-001A/002A **19-5**

Exploded View PN 411168-001C **19-6**

Schematic Diagram PN 411168-001C **19-7**

Parts List PN 411168-001C **19-8**

Exploded View PN 417122-001B **19-9**

Schematic Diagram PN 417122-001B **19-10**

Parts List PN 417122-001B **19-11**

General

Safety

Observe the following warning:

WARNING
The data acquisition module contains the isolation barrier between the patient and the rest of the module. If the data acquisition module is removed, repaired, or replaced for any reason, the module must undergo the current leakage and hi-pot tests listed in Chapter 5: "Preventive Maintenance" before being used on a patient. These tests verify the integrity of the isolation barrier, and are necessary to ensure continued safe operation. Failure to perform the tests may cause undue equipment failure and possible health hazards.

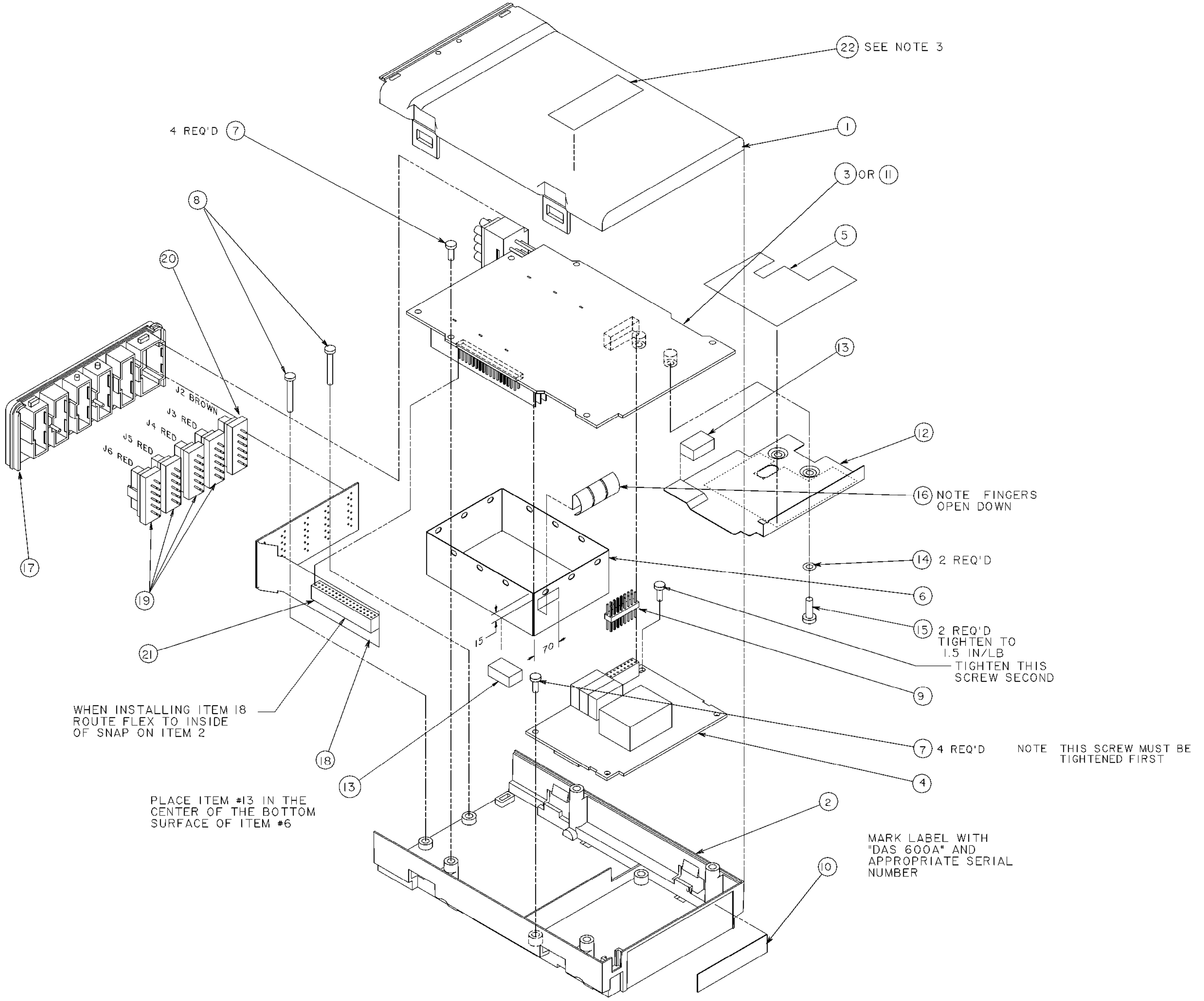
Assembly Configurations

There are four configurations of the data acquisition module described in this chapter. The difference between the assemblies is in the number of ECG leadwires monitored and the acquisition processor PCB used in the DAS module itself. Use the table below to determine which parts lists to use in this manual for your Tram module.

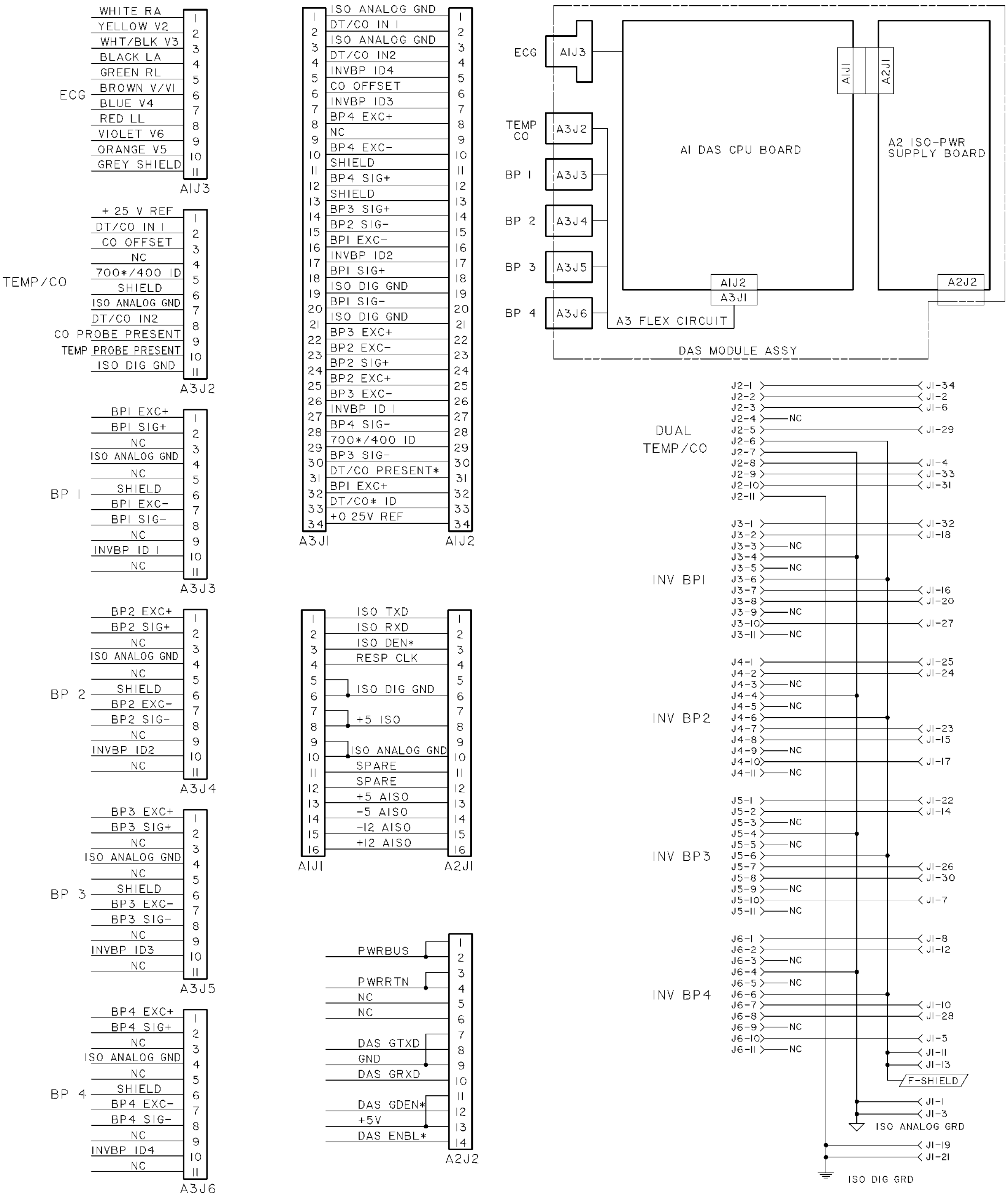
Table 19-1. DAS Module Configurations

Module Type	Leadwire Configuration	DAS Module	Acquisition Processor PCB
Tram 500A	5-Leadwire	408133-001	800330-002
Tram 600A	5-Leadwire	408133-002	800330-004
Tram 600SL	10-Leadwire	411168-001	800330-004
Tram 600SL	10-Leadwire	417122-001 (Replaced 411168-001)	801040-001
Tram 650SL	10-Leadwire	411168-001	800330-004
Tram 650SL	10-Leadwire	417122-001 (Replaced 411168-001)	801040-001

Exploded View PN 408133-001A/002A


(22) SEE NOTE 3
(1)
(3) OR (11)
(5)
(13)
(12)
(16) NOTE FINGERS OPEN DOWN
(14) 2 REQ'D
(6)
(15) 2 REQ'D TIGHTEN TO 1.5 IN/LB
TIGHTEN THIS SCREW SECOND
(9)
(7) 4 REQ'D
NOTE THIS SCREW MUST BE TIGHTENED FIRST
(4)
(2)
(10)
MARK LABEL WITH "DAS 600A" AND APPROPRIATE SERIAL NUMBER
4 REQ'D (7)
(8)
(20)
J2 BROWN
J3 RED
J4 RED
J5 RED
J6 RED
(17)
(19)
(21)
15
70
WHEN INSTALLING ITEM 18 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
(18)
(13)
PLACE ITEM #13 IN THE CENTER OF THE BOTTOM SURFACE OF ITEM #6

Schematic Diagram PN 408133-001A/002A


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/VI
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A1J3
TEMP/CO
+ 25 V REF
DT/CO IN 1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A3J2
BP 1
BP1 EXC+
BP1 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP1 EXC-
BP1 SIG-
NC
INVBP ID 1
NC
A3J3
BP 2
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
A3J4
BP 3
BP3 EXC+
BP3 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP3 EXC-
BP3 SIG-
NC
INVBP ID3
NC
A3J5
BP 4
BP4 EXC+
BP4 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP4 EXC-
BP4 SIG-
NC
INVBP ID4
NC
A3J6
ISO ANALOG GND
DT/CO IN 1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID 1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A3J1
A1J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A1J1
A2J1
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A2J2
ECG
A1J3
TEMP CO
A3J2
BP 1
A3J3
BP 2
A3J4
BP 3
A3J5
BP 4
A3J6
A1J1
A2J1
A1 DAS CPU BOARD
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
INV BP1
J3-1 J1-32
J3-2 J1-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 J1-16
J3-8 J1-20
J3-9 NC
J3-10 J1-27
J3-11 NC
INV BP2
J4-1 J1-25
J4-2 J1-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 J1-23
J4-8 J1-15
J4-9 NC
J4-10 J1-17
J4-11 NC
INV BP3
J5-1 J1-22
J5-2 J1-14
J5-3 NC
J5-4
J5-5 NC
J5-6
J5-7 J1-26
J5-8 J1-30
J5-9 NC
J5-10 J1-7
J5-11 NC
INV BP4
J6-1 J1-8
J6-2 J1-12
J6-3 NC
J6-4
J6-5 NC
J6-6
J6-7 J1-10
J6-8 J1-28
J6-9 NC
J6-10 J1-5
J6-11 NC
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

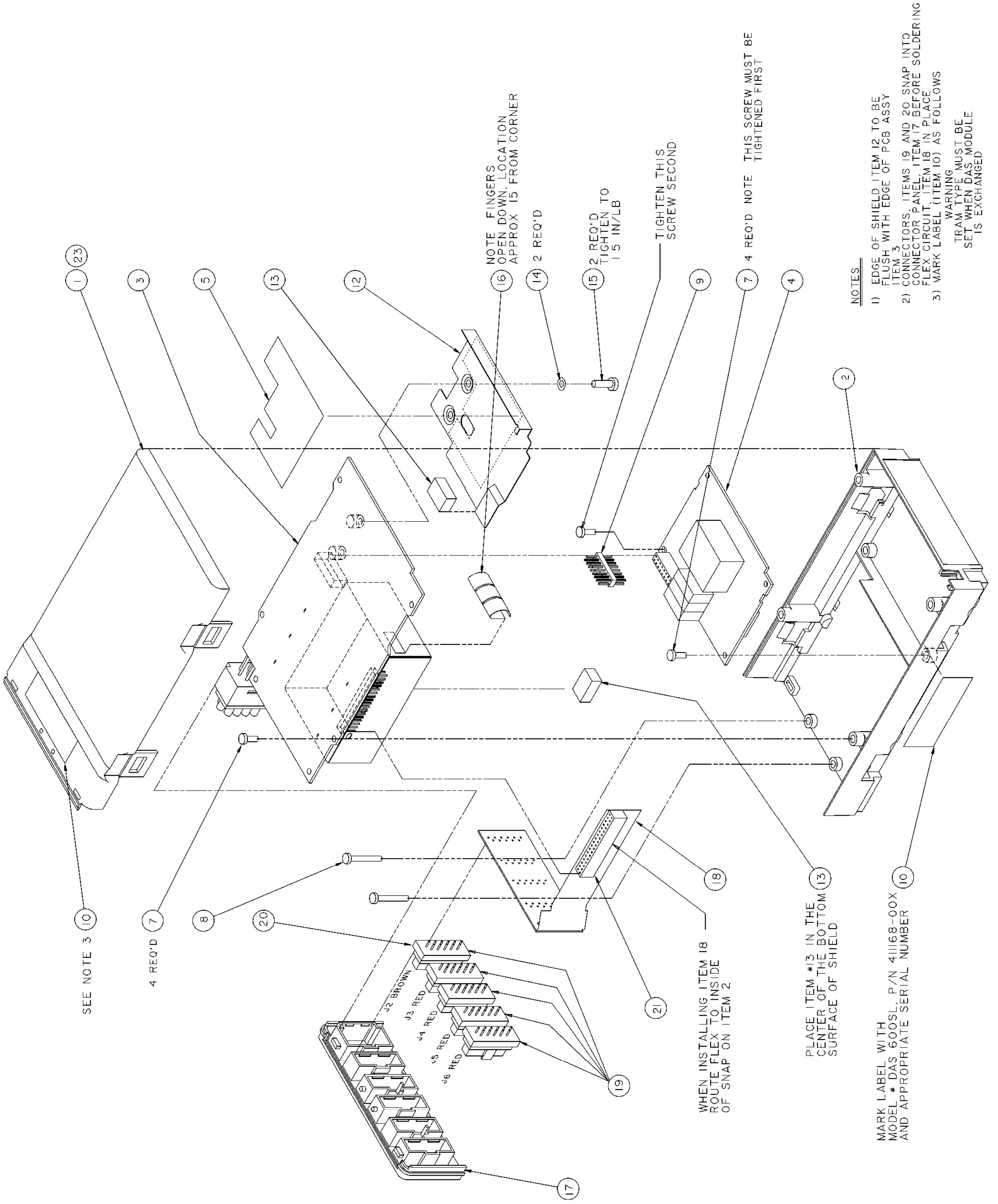
FLEX CIRCUIT SCHEMATIC

ITEM 18

Parts List PN 408133-001A/002A

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Top	401311-001	1
2		Cover, Lower	401681-001	1
3	A1	Acquisition Processor PCB, 5-Lead, 4-BP (For PN 408133-001 Only)	800330-002	1
4	A2	Isolated Power Supply PCB	402329-002	1
5		Insulator	408417-001	1
6		Shield, Hybrids	403283-002	1
7		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
8		Screw, 4-40 x 7/8	404069-001	2
9	A1J1, A2J1	Header, Vertical, 16-Pin	1778-916	1
10		Label, Model/Serial Number	404525-006	1
11	A1	Acquisition Processor PCB, 5-Lead, 4-BP (For PN 408133-002 Only)	800330-004	1
12		Shield, Acquisition Processor PCB, Lower	405517-001	1
13		Tape, Foam	4819-102	AR
14		Washer, Nylon, Flat, No 6	4550-130	2
15		Screw, BDGH, Phillips, 6-32 x 3/16	45074-606	2
16		Spring, Chassis Ground, Rear	403741-001	AR
17		Isolated Connector Panel, Tram 400/500/600 Module	402159-001	1
18	A3	Flex Circuit, BP/Temp	404109-001	1
19	A3J2	Connector, BP (Red)	401762-004	4
20	A3J3 – A3J6	Connector, TEMP/CO (Brown)	401762-021	1
21	A3J1	Connector, 34-Pin, Horizontal	17020-034	1
22		Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED")	404525-001	1

Exploded View PN 411168-001C

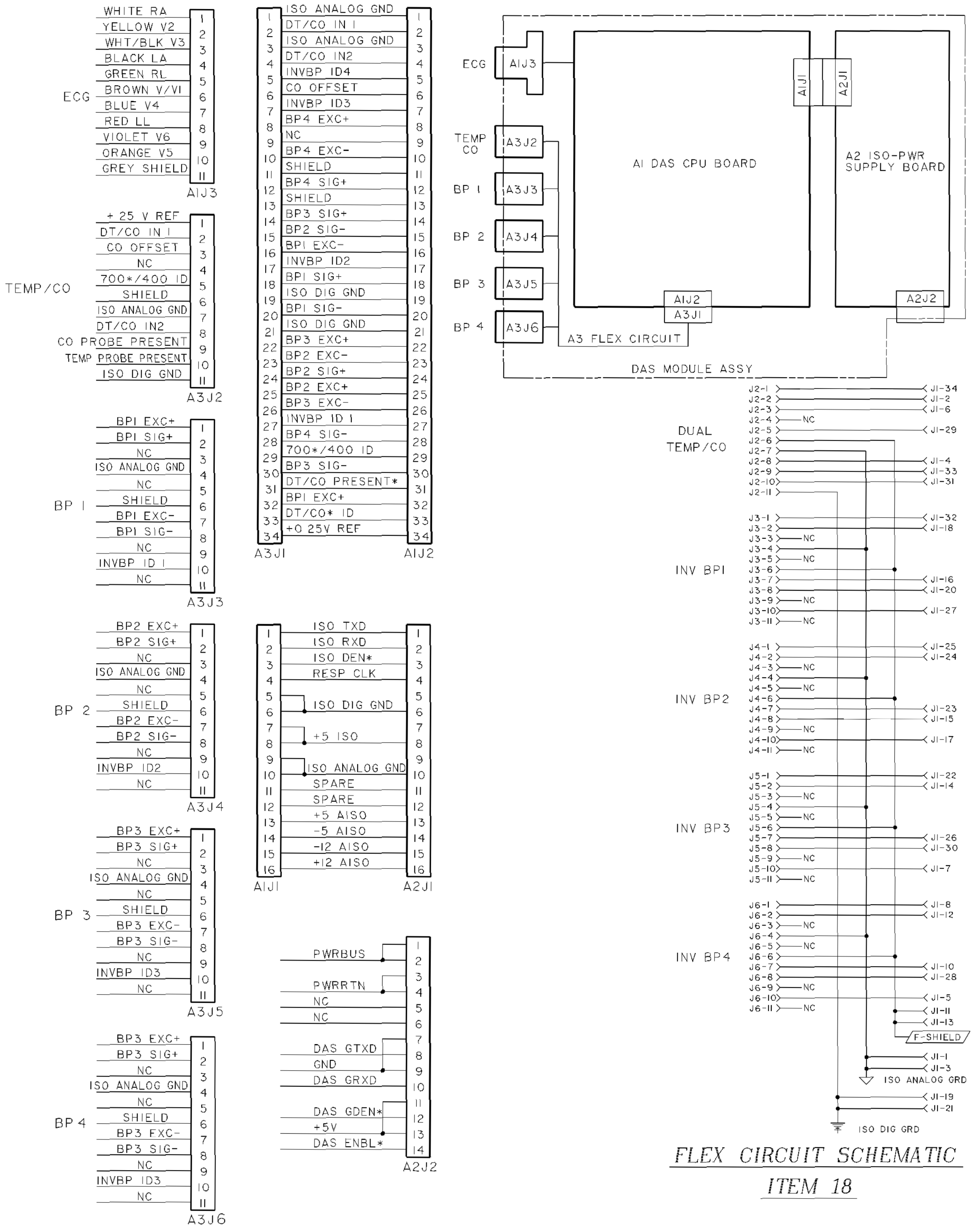

1
23
3
5
13
12
16 NOTE FINGERS OPEN DOWN, LOCATION APPROX 15 FROM CORNER
14 2 REQ'D
15 2 REQ'D TIGHTEN TO 15 IN/LB
TIGHTEN THIS SCREW SECOND
9
7 4 REQ'D NOTE THIS SCREW MUST BE TIGHTENED FIRST
4
2
SEE NOTE 3 10
4 REQ'D 7
8
20
J2 BROWN
J3 RED
J4 RED
J5 RED
J6 RED
19
17
21
WHEN INSTALLING ITEM 18 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
18
PLACE ITEM #13 IN THE CENTER OF THE BOTTOM SURFACE OF SHIELD
13
MARK LABEL WITH MODEL # DAS 600SL, P/N 411168-00X AND APPROPRIATE SERIAL NUMBER
10

NOTES

1) EDGE OF SHIELD ITEM 12 TO BE FLUSH WITH EDGE OF PCB ASSY ITEM 3
2) CONNECTORS, ITEMS 19 AND 20 SNAP INTO CONNECTOR PANEL, ITEM 17 BEFORE SOLDERING FLEX CIRCUIT, ITEM 18 IN PLACE
3) MARK LABEL (ITEM 10) AS FOLLOWS

WARNING
TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED

Schematic Diagram PN 411168-001C


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/V1
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A1J3
TEMP/CO
+ 25 V REF
DT/CO IN 1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A3J2
BP 1
BP1 EXC+
BP1 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP1 EXC-
BP1 SIG-
NC
INVBP ID 1
NC
A3J3
BP 2
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
A3J4
BP 3
BP3 EXC+
BP3 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP3 EXC-
BP3 SIG-
NC
INVBP ID3
NC
A3J5
BP 4
BP3 EXC+
BP3 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP3 FXC-
BP3 SIG-
NC
INVBP ID3
NC
A3J6
ISO ANALOG GND
DT/CO IN 1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID 1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A3J1
A1J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A1J1
A2J1
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A2J2
ECG
A1J3
TEMP CO
A3J2
BP 1
A3J3
BP 2
A3J4
BP 3
A3J5
BP 4
A3J6
A1J1
A2J1
A1 DAS CPU BOARD
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
INV BP1
J3-1 J1-32
J3-2 J1-18
J3-3 NC
J3-4
J3-5 NC
J3-6
J3-7 J1-16
J3-8 J1-20
J3-9 NC
J3-10 J1-27
J3-11 NC
INV BP2
J4-1 J1-25
J4-2 J1-24
J4-3 NC
J4-4
J4-5 NC
J4-6
J4-7 J1-23
J4-8 J1-15
J4-9 NC
J4-10 J1-17
J4-11 NC
INV BP3
J5-1 J1-22
J5-2 J1-14
J5-3 NC
J5-4
J5-5 NC
J5-6
J5-7 J1-26
J5-8 J1-30
J5-9 NC
J5-10 J1-7
J5-11 NC
INV BP4
J6-1 J1-8
J6-2 J1-12
J6-3 NC
J6-4
J6-5 NC
J6-6
J6-7 J1-10
J6-8 J1-28
J6-9 NC
J6-10 J1-5
J6-11 NC
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

FLEX CIRCUIT SCHEMATIC

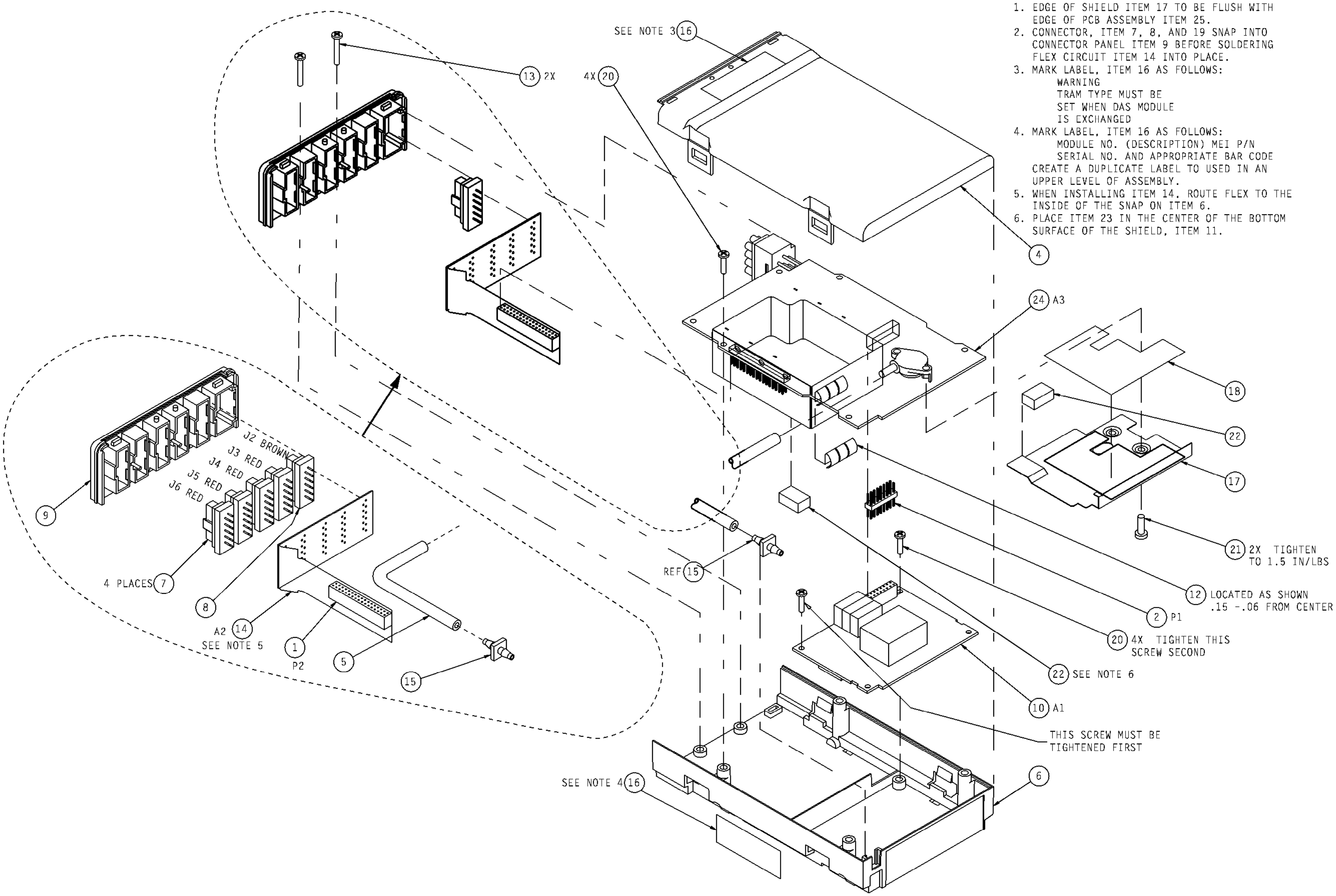
ITEM 18

Parts List PN 411168-001C

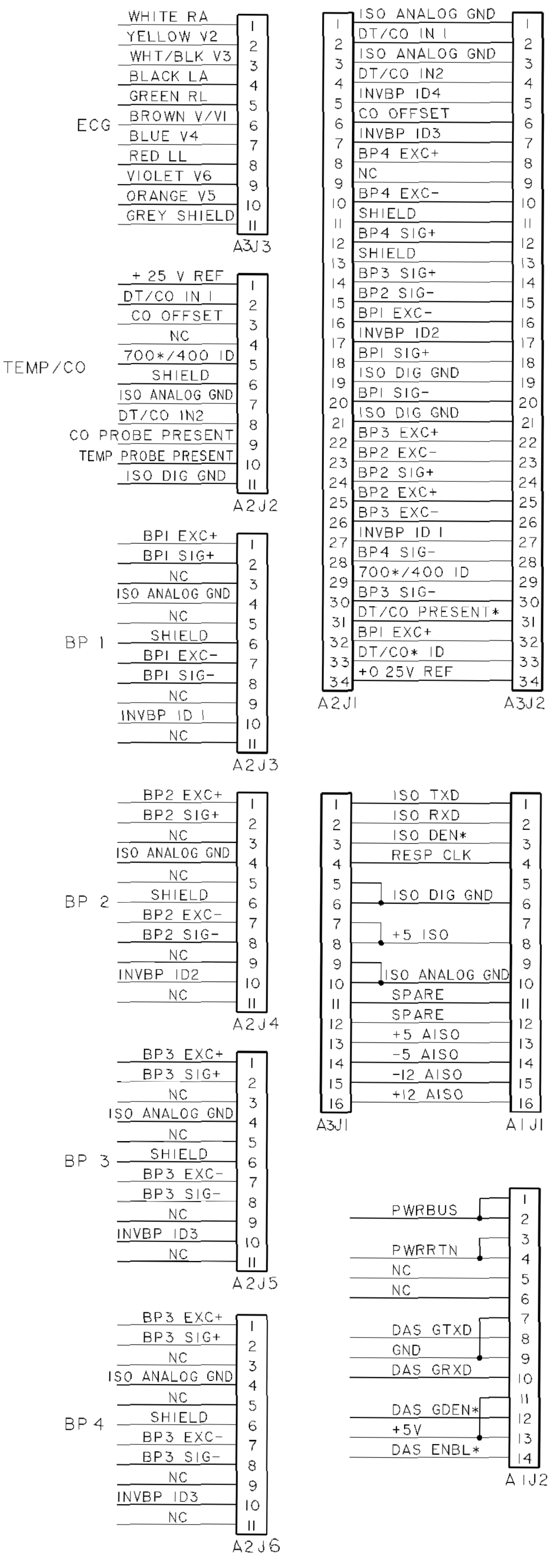
Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Top	401311-001	0
2		Cover, Lower	401681-001	0
3	A1	Acquisition Processor PCB, 10-Lead, 4-BP	800330-004	1
4	A2	Isolated Power Supply PCB	402329-002	1
5		Insulator	408417-001	1
6		Shield, Hybrids	403283-002	1
7		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
8		Screw, 4-40 x 7/8	404069-001	2
9		Header, Vertical, 16-Pin	1778-916	1
10		Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED")	404525-001	2
12		Shield, Acquisition Processor PCB, Lower	405517-001	1
13		Tape, Foam	4819-102	2
14		Washer, Nylon, Flat, No 6	4550-130	2
15		Screw, BDGH, Phillips, 6-32 x 3/16	45074-606	2
16		Spring, Chassis Ground, Rear	403741-001	AR
17		Isolated Connector Panel, Tram 400/500/600 Module	402159-001	1
18	A3	Flex Circuit, BP/Temp	404109-001	1
19		Connector, BP (Red)	401762-004	4
20		Connector, TEMP/CO (Brown)	401762-021	1
21		Connector, 34-Pin, Horizontal	17020-034	1

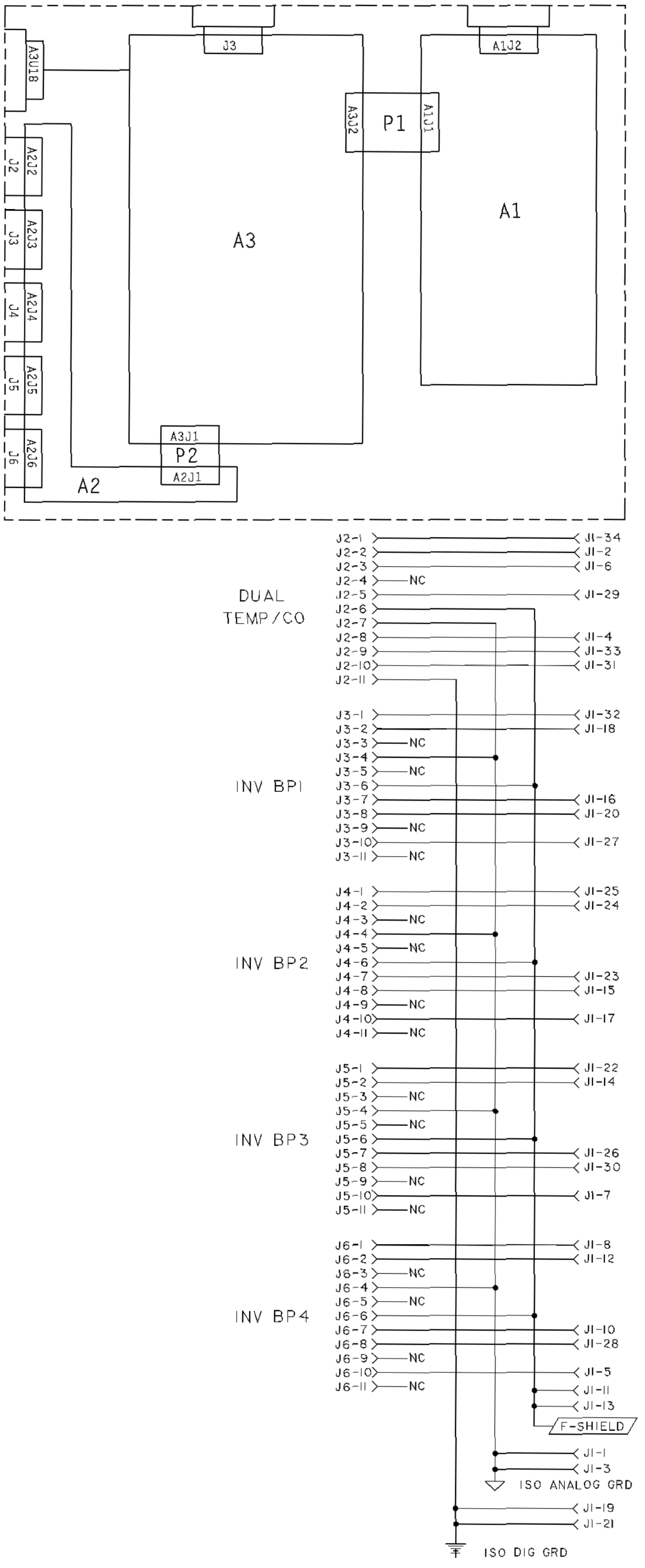
Exploded View PN 417122-001B

NOTES:
1. EDGE OF SHIELD ITEM 17 TO BE FLUSH WITH EDGE OF PCB ASSEMBLY ITEM 25.
2. CONNECTOR, ITEM 7, 8, AND 19 SNAP INTO CONNECTOR PANEL ITEM 9 BEFORE SOLDERING FLEX CIRCUIT ITEM 14 INTO PLACE.
3. MARK LABEL, ITEM 16 AS FOLLOWS:
   WARNING
   TRAM TYPE MUST BE
   SET WHEN DAS MODULE
   IS EXCHANGED
4. MARK LABEL, ITEM 16 AS FOLLOWS:
   MODULE NO. (DESCRIPTION) MEI P/N
   SERIAL NO. AND APPROPRIATE BAR CODE
   CREATE A DUPLICATE LABEL TO USED IN AN UPPER LEVEL OF ASSEMBLY.
5. WHEN INSTALLING ITEM 14, ROUTE FLEX TO THE INSIDE OF THE SNAP ON ITEM 6.
6. PLACE ITEM 23 IN THE CENTER OF THE BOTTOM SURFACE OF THE SHIELD, ITEM 11.


SEE NOTE 3 16
13 2X
4X 20
4
24 A3
18
22
17
21 2X TIGHTEN TO 1.5 IN/LBS
12 LOCATED AS SHOWN .15 -.06 FROM CENTER
2 P1
20 4X TIGHTEN THIS SCREW SECOND
22 SEE NOTE 6
10 A1
THIS SCREW MUST BE TIGHTENED FIRST
6
SEE NOTE 4 16
REF 15
J2 BROWN
J3 RED
J4 RED
J5 RED
J6 RED
9
4 PLACES 7
8
A2 14
SEE NOTE 5
1
P2
5
15

Schematic Diagram PN 417122-001B


WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/V1
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
ECG
A3J3
+ 25 V REF
DT/CO IN 1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
TEMP/CO
A2J2
BP1 EXC+
BP1 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP1 EXC-
BP1 SIG-
NC
INVBP ID 1
NC
BP 1
A2J3
BP2 EXC+
BP2 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP2 EXC-
BP2 SIG-
NC
INVBP ID2
NC
BP 2
A2J4
BP3 EXC+
BP3 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP3 EXC-
BP3 SIG-
NC
INVBP ID3
NC
BP 3
A2J5
BP3 EXC+
BP3 SIG+
NC
ISO ANALOG GND
NC
SHIELD
BP3 EXC-
BP3 SIG-
NC
INVBP ID3
NC
BP 4
A2J6
ISO ANALOG GND
DT/CO IN 1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID 1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A2J1
A3J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A3J1
A1J1
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A1J2


A3U18
J3
A1J2
A3J2
P1
A1J1
J2
A2J2
J3
A2J3
J4
A2J4
J5
A2J5
J6
A2J6
A3
A1
A3J1
P2
A2J1
A2
DUAL
TEMP/CO
J2-1
J1-34
J2-2
J1-2
J2-3
J1-6
J2-4
NC
J2-5
J1-29
J2-6
J2-7
J2-8
J1-4
J2-9
J1-33
J2-10
J1-31
J2-11
INV BP1
J3-1
J1-32
J3-2
J1-18
J3-3
NC
J3-4
J3-5
NC
J3-6
J3-7
J1-16
J3-8
J1-20
J3-9
NC
J3-10
J1-27
J3-11
NC
INV BP2
J4-1
J1-25
J4-2
J1-24
J4-3
NC
J4-4
J4-5
NC
J4-6
J4-7
J1-23
J4-8
J1-15
J4-9
NC
J4-10
J1-17
J4-11
NC
INV BP3
J5-1
J1-22
J5-2
J1-14
J5-3
NC
J5-4
J5-5
NC
J5-6
J5-7
J1-26
J5-8
J1-30
J5-9
NC
J5-10
J1-7
J5-11
NC
INV BP4
J6-1
J1-8
J6-2
J1-12
J6-3
NC
J6-4
J6-5
NC
J6-6
J6-7
J1-10
J6-8
J1-28
J6-9
NC
J6-10
J1-5
J6-11
NC
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

FLEX CIRCUIT SCHEMATIC

Parts List PN 417122-001B

Item	Reference Designation	Parts List	Part Number	Qty
1	P2	Connector, 34-Pin, Horizontal	17020-034	1
2	P1	Header, Vertical, 16-Pin	1778-916	1
4		Cover, Top	401311-001	1
6		Cover, Lower	401681-001	1
7		Connector, BP (Red)	401762-004	4
8		Connector, TEMP/CO (Brown)	401762-021	1
9		Isolated Connector Panel, Tram 400/500/600 Module	402159-001	1
10	A1	Isolated Power Supply PCB	402329-002	1
12		Spring, Chassis Ground, Rear	403741-001	AR
13		Screw, 4-40 x 7/8	404069-001	2
14	A2	Flex Circuit, BP/Temp	404109-001	1
16		Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED")	404525-001	2
17		Shield, Acquisition Processor PCB, Lower	405517-001	1
18		Insulator	408417-001	1
20		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
21		Screw, BDGH, Phillips, 6-32 x 1/2	45074-917	2
22		Tape, Foam	4819-102	2
24	A3	Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP	801040-001	1

For your notes

20

800 ACQUISITION MODULE PN 411068/411025/417123/417124

General **20-2**
Safety 20-2
Assembly Configurations 20-2

Exploded View PN 411068-001C **20-3**

Schematic Diagram PN 411068-001C **20-4**

Parts List PN 411068-001C **20-5**

Exploded View PN 411025-001C **20-6**

Schematic Diagram PN 411025-001C **20-7**

Parts List PN 411025-001C **20-8**

Exploded View PN 417123-001B/417124-001B **20-9**

Schematic Diagram PN 417123-001B/417124-001B **20-10**

Parts List PN 417123-001B/417124-001B **20-11**

General

Safety

Observe the following warning:

WARNING
The data acquisition module contains the isolation barrier between the patient and the rest of the module. If the data acquisition module is removed, repaired, or replaced for any reason, the module must undergo the current leakage and hi-pot tests listed in Chapter 5: “Preventive Maintenance” before being used on a patient. These tests verify the integrity of the isolation barrier, and are necessary to ensure continued safe operation. Failure to perform the tests may cause undue equipment failure and possible health hazards.

Assembly Configurations

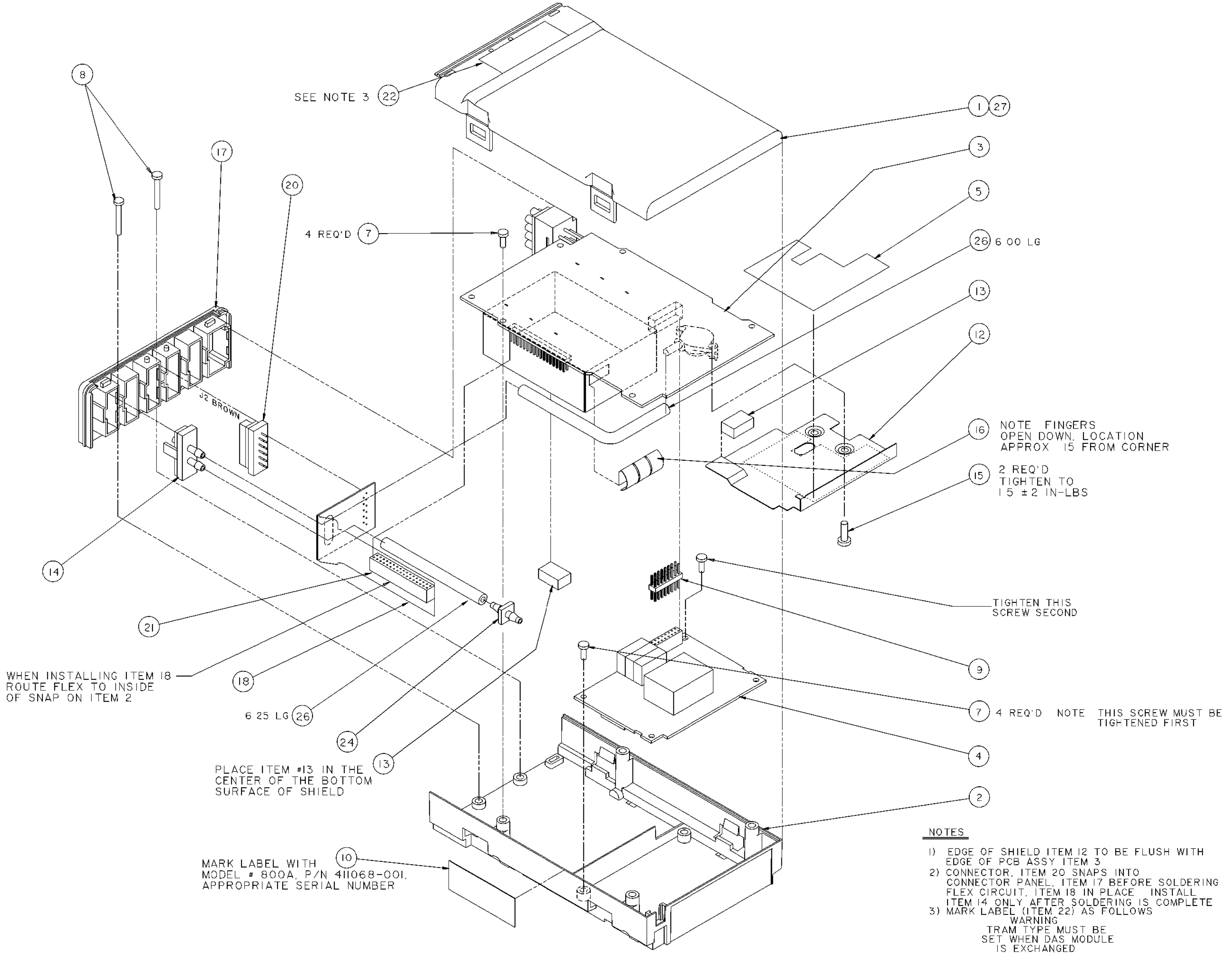
There are four configurations of the data acquisition module described in this chapter. The difference between the assemblies is in the number of ECG leadwires monitored and the acquisition processor PCB used in the DAS module itself. Use the table below to determine which parts lists to use in this manual for your Tram module.

Table 20-1. DAS Module Configurations

Module Type	Leadwire Configuration	DAS Module	Acquisition Processor PCB
Tram 800A	5-Leadwire	411068-001	800330-011
Tram 800A	5-Leadwire	417124-001 (Replaced 411068-001)	801040-002
Tram 800SL	10-Leadwire	411025-001	800330-012
Tram 800SL	10-Leadwire	417123-001 (Replaced 411025-001)	801040-001
Tram 850A	5-Leadwire	411068-001	800330-011
Tram 850A	5-Leadwire	417124-001 (Replaces 411068-001)	801040-001
Tram 850SL	10-Leadwire	411025-001	800330-012
Tram 850SL	10-Leadwire	417123-001 (Replaces 411025-001)	801040-001

Exploded View

PN 411068-001C

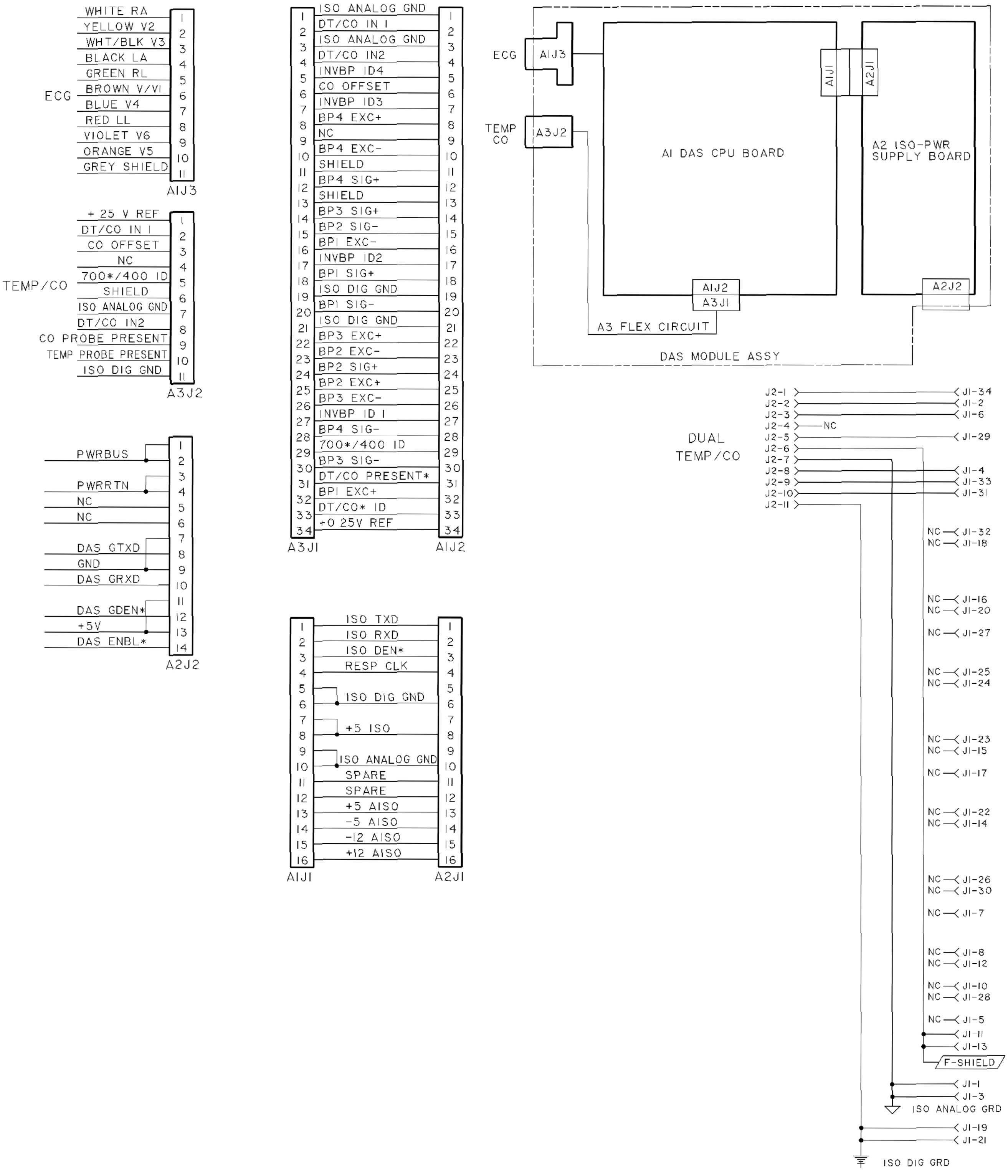

8
17
20
SEE NOTE 3 22
1 27
3
5
26 6 00 LG
13
12
4 REQ'D 7
J2 BROWN
16 NOTE FINGERS OPEN DOWN, LOCATION APPROX 15 FROM CORNER
15 2 REQ'D TIGHTEN TO 15 ±2 IN-LBS
14
TIGHTEN THIS SCREW SECOND
21
WHEN INSTALLING ITEM 18 ROUTE FLEX TO INSIDE OF SNAP ON ITEM 2
18
6 25 LG 26
24
9
7 4 REQ'D NOTE THIS SCREW MUST BE TIGHTENED FIRST
4
PLACE ITEM #13 IN THE CENTER OF THE BOTTOM SURFACE OF SHIELD
13
2
MARK LABEL WITH MODEL # 800A, P/N 411068-001, APPROPRIATE SERIAL NUMBER
10

NOTES

1) EDGE OF SHIELD ITEM 12 TO BE FLUSH WITH EDGE OF PCB ASSY ITEM 3
2) CONNECTOR, ITEM 20 SNAPS INTO CONNECTOR PANEL, ITEM 17 BEFORE SOLDERING FLEX CIRCUIT, ITEM 18 IN PLACE INSTALL ITEM 14 ONLY AFTER SOLDERING IS COMPLETE
3) MARK LABEL (ITEM 22) AS FOLLOWS

WARNING
TRAM TYPE MUST BE
SET WHEN DAS MODULE
IS EXCHANGED

Schematic Diagram PN 411068-001C


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/VI
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A1J3
TEMP/CO
+ 25 V REF
DT/CO IN 1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A3J2
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A2J2
ISO ANALOG GND
DT/CO IN 1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID 1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0 25V REF
A3J1
A1J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A1J1
A2J1
ECG
A1J3
TEMP CO
A3J2
A1J1
A2J1
A1 DAS CPU BOARD
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
J2-1
J2-2
J2-3
J2-4
J2-5
J2-6
J2-7
J2-8
J2-9
J2-10
J2-11
NC
J1-34
J1-2
J1-6
J1-29
J1-4
J1-33
J1-31
NC J1-32
NC J1-18
NC J1-16
NC J1-20
NC J1-27
NC J1-25
NC J1-24
NC J1-23
NC J1-15
NC J1-17
NC J1-22
NC J1-14
NC J1-26
NC J1-30
NC J1-7
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

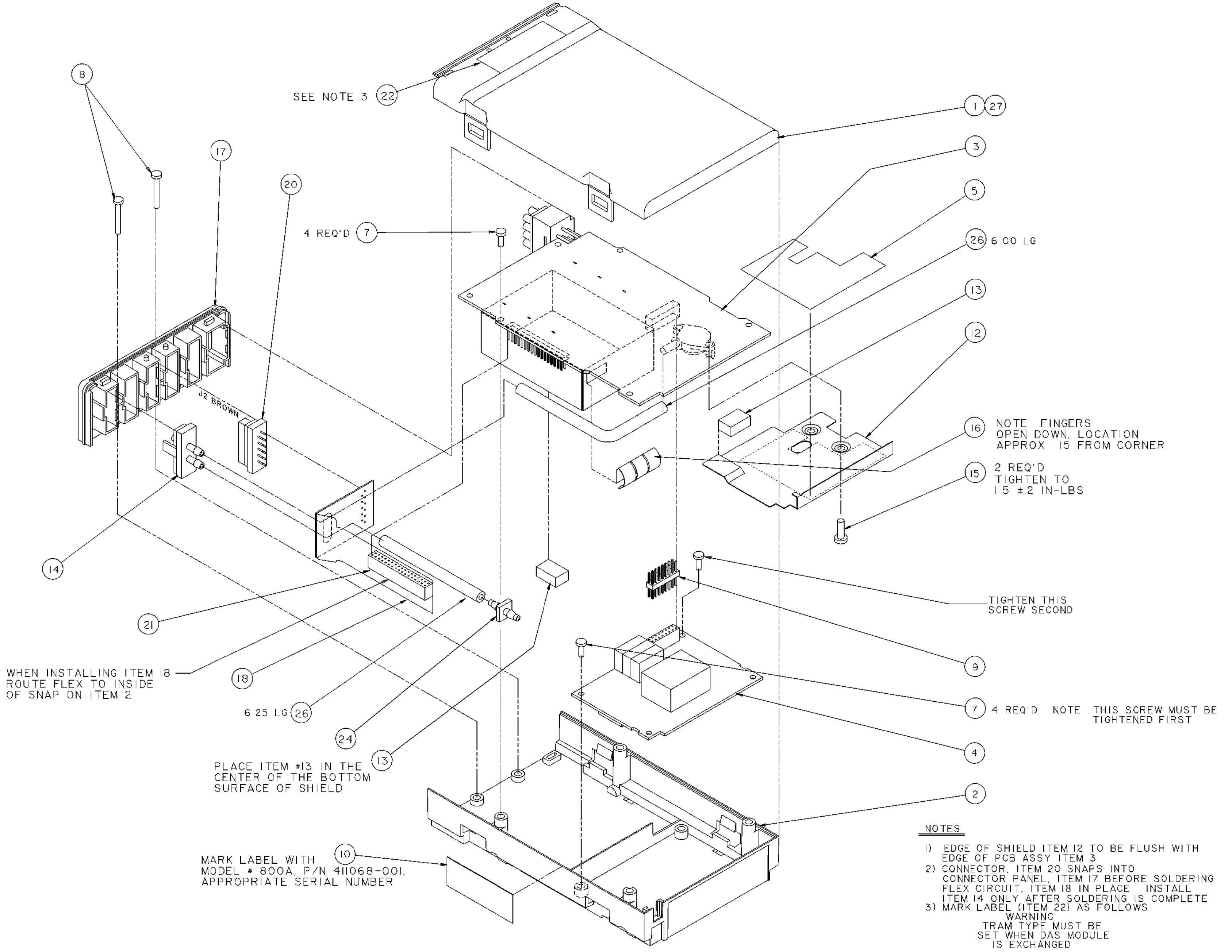
FLEX CIRCUIT SCHEMATIC

ITEM 18

Parts List PN 411068-001C

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Top	401311-001	0
2		Cover, Lower	401681-001	0
3	A1	Acquisition Processor PCB, 5-Lead	800330-011	1
4	A2	Isolated Power Supply PCB	402329-002	1
5		Insulator	408417-001	1
7		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
8		Screw, 4-40 x 7/8	404069-001	2
9		Header, Vertical, 16-Pin	1778-916	1
10		Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED")	404525-001	2
12		Shield, Acquisition Processor PCB, Lower	405517-001	1
13		Tape, Foam	4819-102	2
14		Connector, Pneumatic, NBP, Recessed	414640-002	1
15		Screw, BDGH, Phillips, 6-32 x 1/2	45074-917	2
16		Spring, Chassis Ground, Rear	403741-001	AR
17		Isolated Connector Panel, Tram 800	402159-004	1
18	A3	Flex Circuit, Temp	800397-003	1
20		Connector, TEMP/CO (Brown)	401762-021	1
21		Connector, 34-Pin, Horizontal	17020-034	1
22		Label	404525-001	1
24		Connector, Pneumatic	404445-001	1
26		Tubing, Silastic	401582-001	AR

Exploded View PN 411025-001C



SEE NOTE 3

4 REQ'D

6 00 LG

NOTE FINGERS
OPEN DOWN, LOCATION
APPROX 15 FROM CORNER

2 REQ'D
TIGHTEN TO
1 5 ±2 IN-LBS

TIGHTEN THIS
SCREW SECOND

4 REQ'D   NOTE   THIS SCREW MUST BE
TIGHTENED FIRST

WHEN INSTALLING ITEM 18
ROUTE FLEX TO INSIDE
OF SNAP ON ITEM 2

6 25 LG

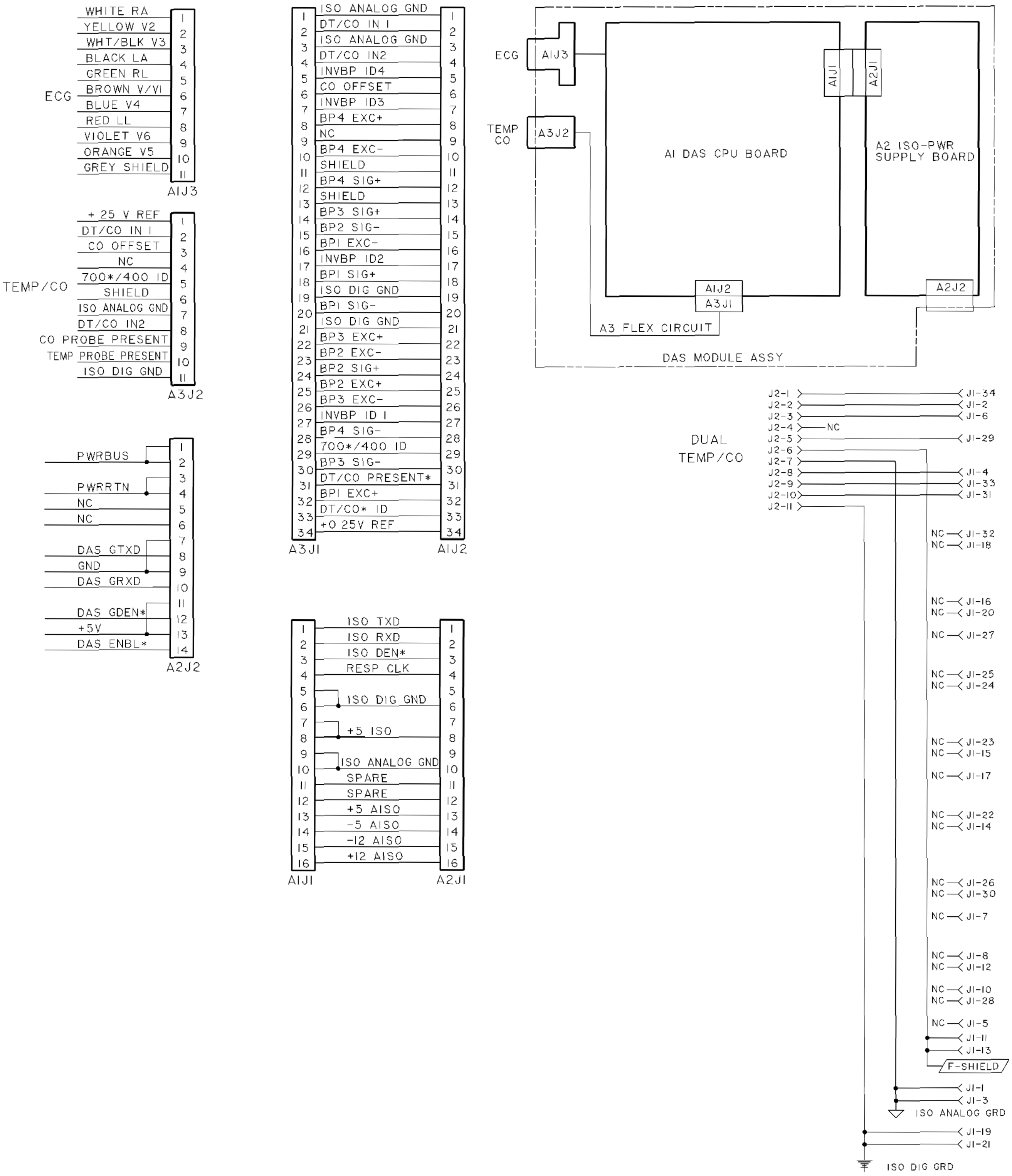
PLACE ITEM #13 IN THE
CENTER OF THE BOTTOM
SURFACE OF SHIELD

MARK LABEL WITH
MODEL # 800A, P/N 411068-001,
APPROPRIATE SERIAL NUMBER

NOTES

1) EDGE OF SHIELD ITEM 12 TO BE FLUSH WITH
EDGE OF PCB ASSY ITEM 3
2) CONNECTOR, ITEM 20 SNAPS INTO
CONNECTOR PANEL, ITEM 17 BEFORE SOLDERING
FLEX CIRCUIT, ITEM 18 IN PLACE INSTALL
ITEM 14 ONLY AFTER SOLDERING IS COMPLETE
3) MARK LABEL (ITEM 22) AS FOLLOWS
WARNING
TRAM TYPE MUST BE
SET WHEN DAS MODULE
IS EXCHANGED

Schematic Diagram PN 411025-001C


ECG
WHITE RA
YELLOW V2
WHT/BLK V3
BLACK LA
GREEN RL
BROWN V/V1
BLUE V4
RED LL
VIOLET V6
ORANGE V5
GREY SHIELD
A1J3
TEMP/CO
+ 25 V REF
DT/CO IN 1
CO OFFSET
NC
700*/400 ID
SHIELD
ISO ANALOG GND
DT/CO IN2
CO PROBE PRESENT
TEMP PROBE PRESENT
ISO DIG GND
A3J2
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A2J2
ISO ANALOG GND
DT/CO IN 1
ISO ANALOG GND
DT/CO IN2
INVBP ID4
CO OFFSET
INVBP ID3
BP4 EXC+
NC
BP4 EXC-
SHIELD
BP4 SIG+
SHIELD
BP3 SIG+
BP2 SIG-
BP1 EXC-
INVBP ID2
BP1 SIG+
ISO DIG GND
BP1 SIG-
ISO DIG GND
BP3 EXC+
BP2 EXC-
BP2 SIG+
BP2 EXC+
BP3 EXC-
INVBP ID 1
BP4 SIG-
700*/400 ID
BP3 SIG-
DT/CO PRESENT*
BP1 EXC+
DT/CO* ID
+0.25V REF
A3J1
A1J2
ISO TXD
ISO RXD
ISO DEN*
RESP CLK
ISO DIG GND
+5 ISO
ISO ANALOG GND
SPARE
SPARE
+5 AISO
-5 AISO
-12 AISO
+12 AISO
A1J1
A2J1
ECG
A1J3
TEMP CO
A3J2
A1J1
A2J1
A1 DAS CPU BOARD
A2 ISO-PWR SUPPLY BOARD
A1J2
A3J1
A2J2
A3 FLEX CIRCUIT
DAS MODULE ASSY
DUAL TEMP/CO
J2-1 J1-34
J2-2 J1-2
J2-3 J1-6
J2-4 NC
J2-5 J1-29
J2-6
J2-7
J2-8 J1-4
J2-9 J1-33
J2-10 J1-31
J2-11
NC J1-32
NC J1-18
NC J1-16
NC J1-20
NC J1-27
NC J1-25
NC J1-24
NC J1-23
NC J1-15
NC J1-17
NC J1-22
NC J1-14
NC J1-26
NC J1-30
NC J1-7
NC J1-8
NC J1-12
NC J1-10
NC J1-28
NC J1-5
J1-11
J1-13
F-SHIELD
J1-1
J1-3
ISO ANALOG GRD
J1-19
J1-21
ISO DIG GRD

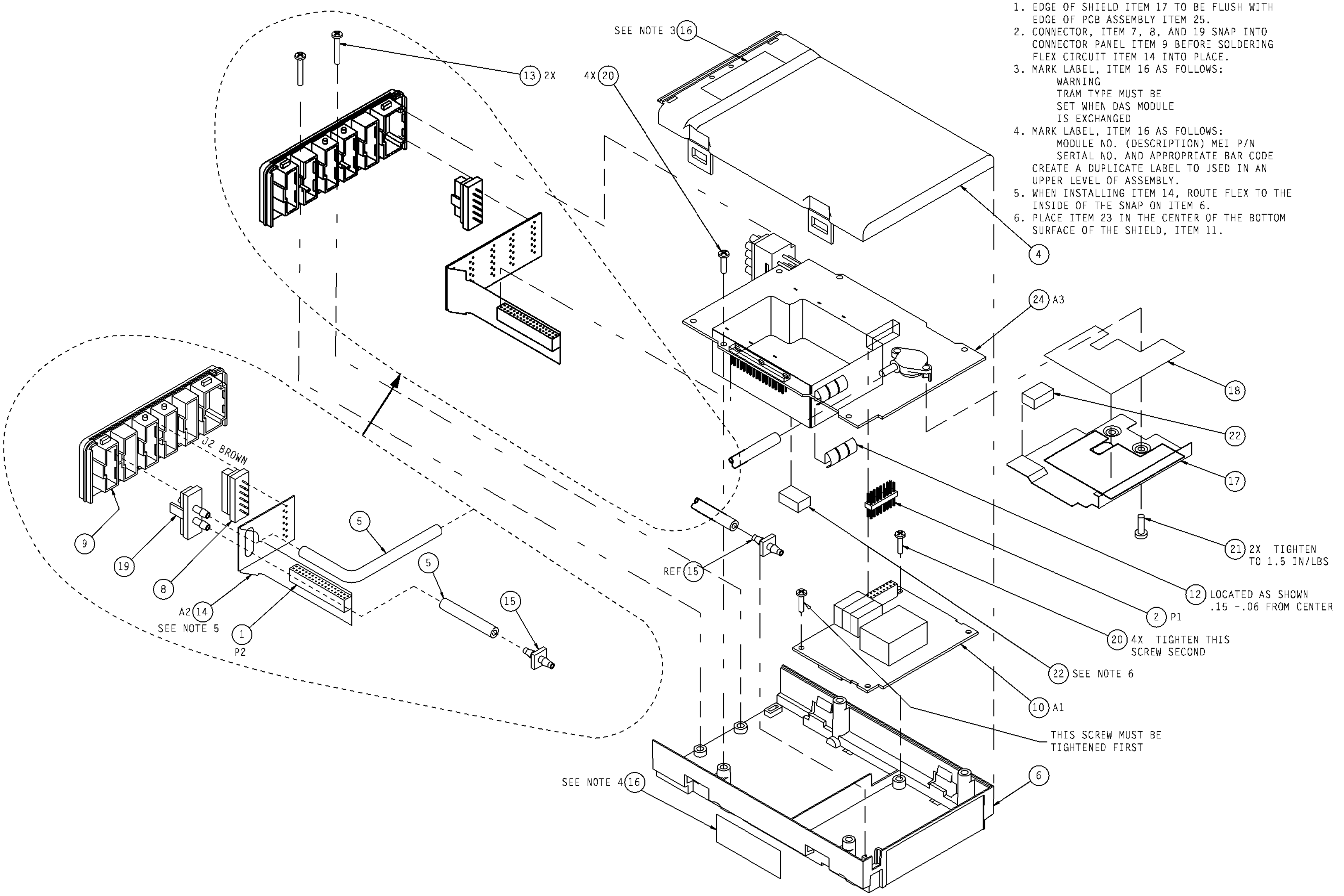
FLEX CIRCUIT SCHEMATIC

ITEM 18

Parts List PN 411025-001C

Item	Reference Designation	Parts List	Part Number	Qty
1		Cover, Top	401311-001	0
2		Cover, Lower	401681-001	0
3	A1	Acquisition Processor PCB, 10-Lead	800330-012	1
4	A2	Isolated Power Supply PCB	402329-002	1
5		Insulator	408417-001	1
7		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
8		Screw, 4-40 x 7/8	404069-001	2
9		Header, Vertical, 16-Pin	1778-916	1
10		Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED")	404525-001	2
12		Shield, Acquisition Processor PCB, Lower	405517-001	1
13		Tape, Foam	4819-102	2
14		Connector, Pneumatic, NBP, Recessed	414640-002	1
15		Screw, BDGH, Phillips, 6-32 x 1/2	45074-917	2
16		Spring, Chassis Ground, Rear	403741-001	0.1
17		Isolated Connector Panel, Tram 800	402159-004	1
18	A3	Flex Circuit, Temp	800397-003	1
20		Connector, TEMP/CO (Brown)	401762-021	1
21		Connector, 34-Pin, Horizontal	17020-034	1
22		Label	404525-001	1
24		Connector, Pneumatic	404445-001	1
26		Tubing, Silastic	401582-001	AR

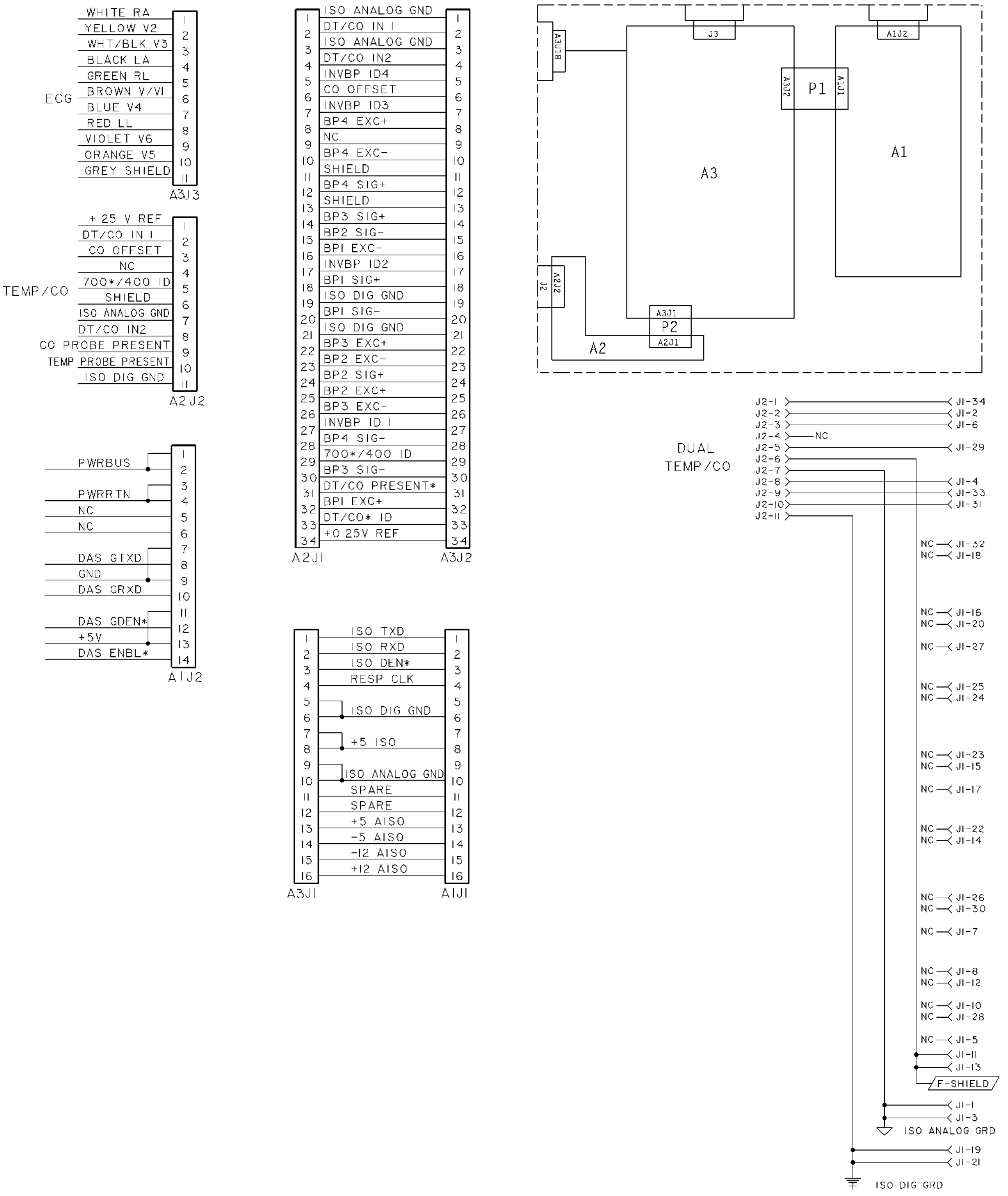
Exploded View PN 417123-001B/417124-001B


SEE NOTE 3 16
4X 20
13 2X
4
24 A3
18
22
17
21 2X TIGHTEN TO 1.5 IN/LBS
12 LOCATED AS SHOWN .15 -.06 FROM CENTER
2 P1
20 4X TIGHTEN THIS SCREW SECOND
22 SEE NOTE 6
10 A1
THIS SCREW MUST BE TIGHTENED FIRST
6
SEE NOTE 4 16
REF 15
J2 BROWN
5
5
15
9
19
8
A2 14
SEE NOTE 5
1
P2

NOTES:

1. EDGE OF SHIELD ITEM 17 TO BE FLUSH WITH EDGE OF PCB ASSEMBLY ITEM 25.
2. CONNECTOR, ITEM 7, 8, AND 19 SNAP INTO CONNECTOR PANEL ITEM 9 BEFORE SOLDERING FLEX CIRCUIT ITEM 14 INTO PLACE.
3. MARK LABEL, ITEM 16 AS FOLLOWS:
   WARNING
   TRAM TYPE MUST BE
   SET WHEN DAS MODULE
   IS EXCHANGED
4. MARK LABEL, ITEM 16 AS FOLLOWS:
   MODULE NO. (DESCRIPTION) MEI P/N
   SERIAL NO. AND APPROPRIATE BAR CODE
   CREATE A DUPLICATE LABEL TO USED IN AN UPPER LEVEL OF ASSEMBLY.
5. WHEN INSTALLING ITEM 14, ROUTE FLEX TO THE INSIDE OF THE SNAP ON ITEM 6.
6. PLACE ITEM 23 IN THE CENTER OF THE BOTTOM SURFACE OF THE SHIELD, ITEM 11.

Schematic Diagram PN 417123-001B/417124-001B


ECG
WHITE RA 1
YELLOW V2 2
WHT/BLK V3 3
BLACK LA 4
GREEN RL 5
BROWN V/VI 6
BLUE V4 7
RED LL 8
VIOLET V6 9
ORANGE V5 10
GREY SHIELD 11
A3J3
TEMP/CO
+ 25 V REF 1
DT/CO IN I 2
CO OFFSET 3
NC 4
700*/400 ID 5
SHIELD 6
ISO ANALOG GND 7
DT/CO IN2 8
CO PROBE PRESENT 9
TEMP PROBE PRESENT 10
ISO DIG GND 11
A2J2
PWRBUS
PWRRTN
NC
NC
DAS GTXD
GND
DAS GRXD
DAS GDEN*
+5V
DAS ENBL*
A1J2
ISO ANALOG GND 1
DT/CO IN I 2
ISO ANALOG GND 3
DT/CO IN2 4
INVBP ID4 5
CO OFFSET 6
INVBP ID3 7
BP4 EXC+ 8
NC 9
BP4 EXC- 10
SHIELD 11
BP4 SIG+ 12
SHIELD 13
BP3 SIG+ 14
BP2 SIG- 15
BPI EXC- 16
INVBP ID2 17
BPI SIG+ 18
ISO DIG GND 19
BPI SIG- 20
ISO DIG GND 21
BP3 EXC+ 22
BP2 EXC- 23
BP2 SIG+ 24
BP2 EXC+ 25
BP3 EXC- 26
INVBP ID I 27
BP4 SIG- 28
700*/400 ID 29
BP3 SIG- 30
DT/CO PRESENT* 31
BPI EXC+ 32
DT/CO* ID 33
+0 25V REF 34
A2J1
A3J2
ISO TXD 1
ISO RXD 2
ISO DEN* 3
RESP CLK 4
ISO DIG GND 5 6
+5 ISO 7 8
ISO ANALOG GND 9 10
SPARE 11
SPARE 12
+5 AISO 13
-5 AISO 14
-12 AISO 15
+12 AISO 16
A3J1
A1J1
A3U18
J3
A1J2
A3J2
P1
A1J1
A1
A3
J2
A2J2
A3J1
P2
A2J1
A2
DUAL TEMP/CO
J2-1 JI-34
J2-2 JI-2
J2-3 JI-6
J2-4 NC
J2-5 JI-29
J2-6
J2-7
J2-8 JI-4
J2-9 JI-33
J2-10 JI-31
J2-11
NC JI-32
NC JI-18
NC JI-16
NC JI-20
NC JI-27
NC JI-25
NC JI-24
NC JI-23
NC JI-15
NC JI-17
NC JI-22
NC JI-14
NC JI-26
NC JI-30
NC JI-7
NC JI-8
NC JI-12
NC JI-10
NC JI-28
NC JI-5
JI-11
JI-13
F-SHIELD
JI-1
JI-3
ISO ANALOG GRD
JI-19
JI-21
ISO DIG GRD

FLEX CIRCUIT SCHEMATIC

Parts List PN 417123-001B/417124-001B

Item	Reference Designation	Parts List	Part Number	Qty
1	P2	Connector, 34-Pin, Horizontal	17020-034	1
2	P1	Header, Vertical, 16-Pin	1778-916	1
4		Cover, Top	401311-001	1
5		Tubing, Silastic	401582-001	AR
6		Cover, Lower	401681-001	1
7		Connector, BP (Red)	401762-004	2
8		Connector, TEMP/CO (Brown)	401762-021	1
9		Isolated Connector Panel, Tram 800	402159-004	1
10	A1	Isolated Power Supply PCB	402329-002	1
12		Spring, Chassis Ground, Rear	403741-001	AR
13		Screw, 4-40 x 7/8	404069-001	2
14	A2	Flex Circuit, BP/Temp	800397-003	1
15		Connector, Pneumatic	404445-001	1
16		Label (Marked with "WARNING, TRAM TYPE MUST BE SET WHEN DAS MODULE IS EXCHANGED")	404525-001	2
17		Shield, Acquisition Processor PCB, Lower	405517-001	1
18		Insulator	408417-001	1
19		Socket, NBP w/o Key	414640-002	1
20		Screw, BDGH, Phillips, 4-40 x 3/16	45074-406	8
21		Screw, BDGH, Phillips, 6-32 x 1/2	45074-917	2
22		Tape, Foam	4819-102	2
24	A3	Acquisition Processor PCB, 5-Lead, 2-BP, W/NBP (For 417124-001 Only)	801040-001	1
24	A3	Acquisition Processor PCB, 10-Lead, 2-BP, W/NBP (For 417123-001 Only)	801040-002	1

For your notes

21

NBP VALVE ASSEMBLY
PN 416153

General **21-2**

Exploded View PN 416153-001A **21-3**

Exploded View PN 413021-001B/404459-001C **21-4**

Parts List PN 413021-001B/404459-001C **21-5**

General

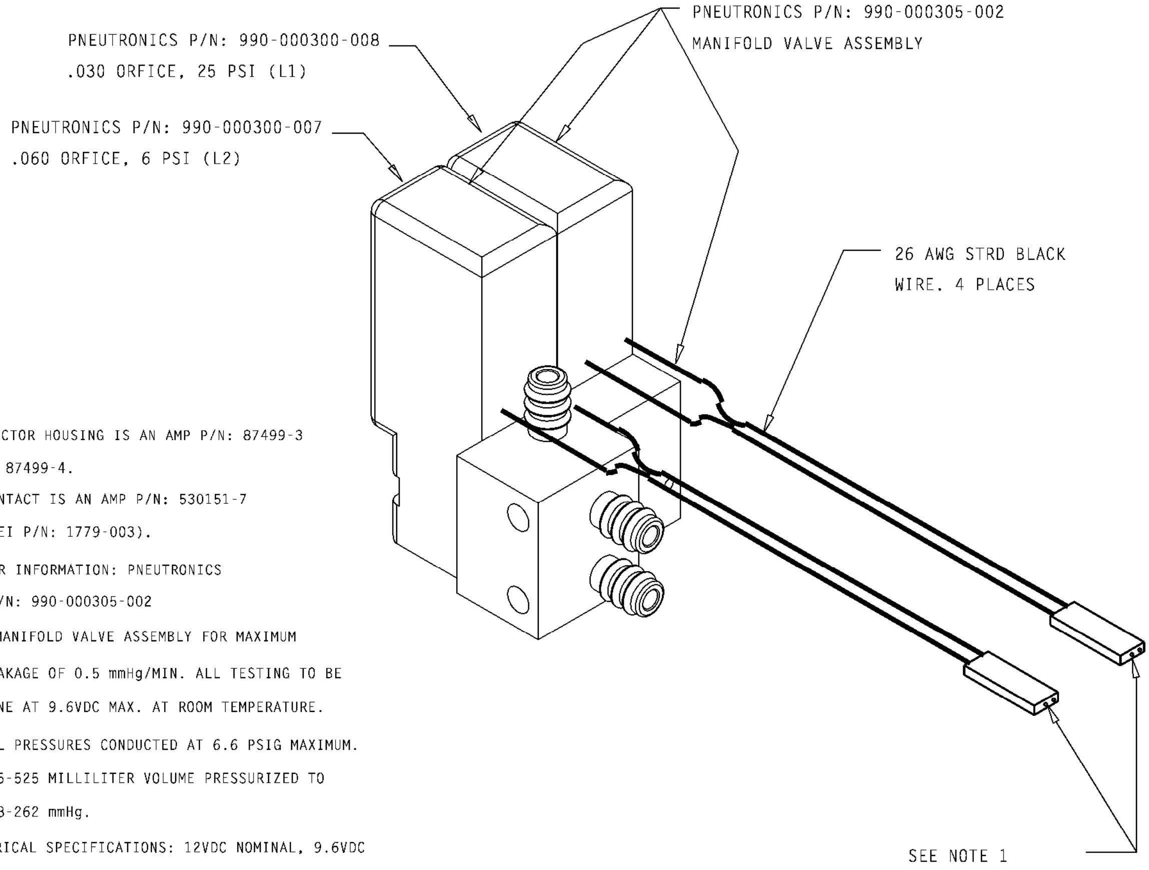
This chapter describes the NBP valve assembly used in the Tram 100A, 200A/SL, 250SL,400A/SL, 450SL, 800A/SL, and 850A/SL modules. A parts list and an exploded view are presented in this chapter.

The NBP valve assembly contains the pressure release valves that regulate the air pressure in the noninvasive blood pressure cuff. Because it is manufactured by a vendor, no parts lists is provided.

Older assemblies pn 413021-001 and pn 404459-001 are included in this chapter for reference only, but they should be replaced with the pn 416153-001 version if the assembly proves defective.

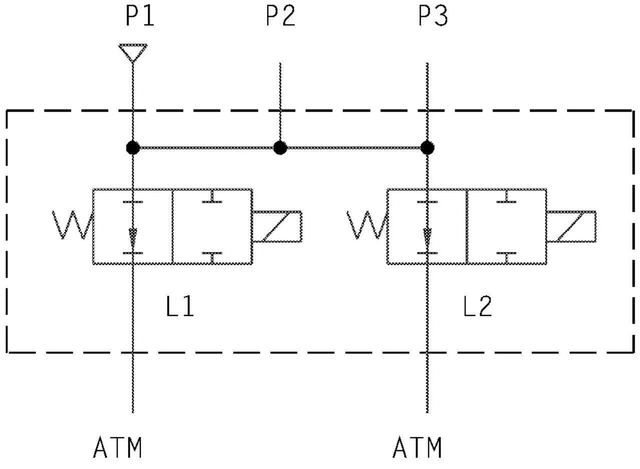
Exploded View

PN 416153-001A


PNEUTRONICS P/N: 990-000300-008
.030 ORFICE, 25 PSI (L1)
PNEUTRONICS P/N: 990-000300-007
.060 ORFICE, 6 PSI (L2)
PNEUTRONICS P/N: 990-000305-002
MANIFOLD VALVE ASSEMBLY
26 AWG STRD BLACK
WIRE, 4 PLACES
SEE NOTE 1

NOTES:

1. CONNECTOR HOUSING IS AN AMP P/N: 87499-3 OR 87499-4. CONTACT IS AN AMP P/N: 530151-7 (MEI P/N: 1779-003).
2. VENDOR INFORMATION: PNEUTRONICS P/N: 990-000305-002
3. TEST MANIFOLD VALVE ASSEMBLY FOR MAXIMUM LEAKAGE OF 0.5 mmHg/MIN. ALL TESTING TO BE DONE AT 9.6VDC MAX. AT ROOM TEMPERATURE. ALL PRESSURES CONDUCTED AT 6.6 PSIG MAXIMUM. 475-525 MILLILITER VOLUME PRESSURIZED TO 238-262 mmHg.
4. ELECTRICAL SPECIFICATIONS: 12VDC NOMINAL, 9.6VDC MINIMUM, 0.50-0.56W, 257-288 OHM.
5. TEST FLOW RATE ON VALVE AUTOMATIC TESTER (MEI MT4500) VALVE PRESSURE DROP (mmHg):
   L1 = 75-104
   L2 = 40-77
   475-525 MILLILITER VOLUME PRESSURIZED TO 200 -2 mmHg.
6. PACKAGING SHALL BE CLEAN AND FREE OF LOOSE PARTICLES. PACKAGE ASSEMBLIES IN CLOSED ANTISTATIC BAGS TO PREVENT CONTAMINATION.
7. OPERATING TEMPERATURE RANGE: 0i TO 70iC.
8. ANY CHANGES TO THIS ASSEMBLY AND/OR VALVES MUST HAVE WRITTEN APPROVAL FROM MEI ENGINEERING.
9. LABEL THE MANIFOLD VALVE ASSEMBLY WITH: P/N 990-000305-002 AND DATE CODE. LABEL EACH VALVE WITH PNEUTRONICS PART NUMBER AND 9.6VDC.

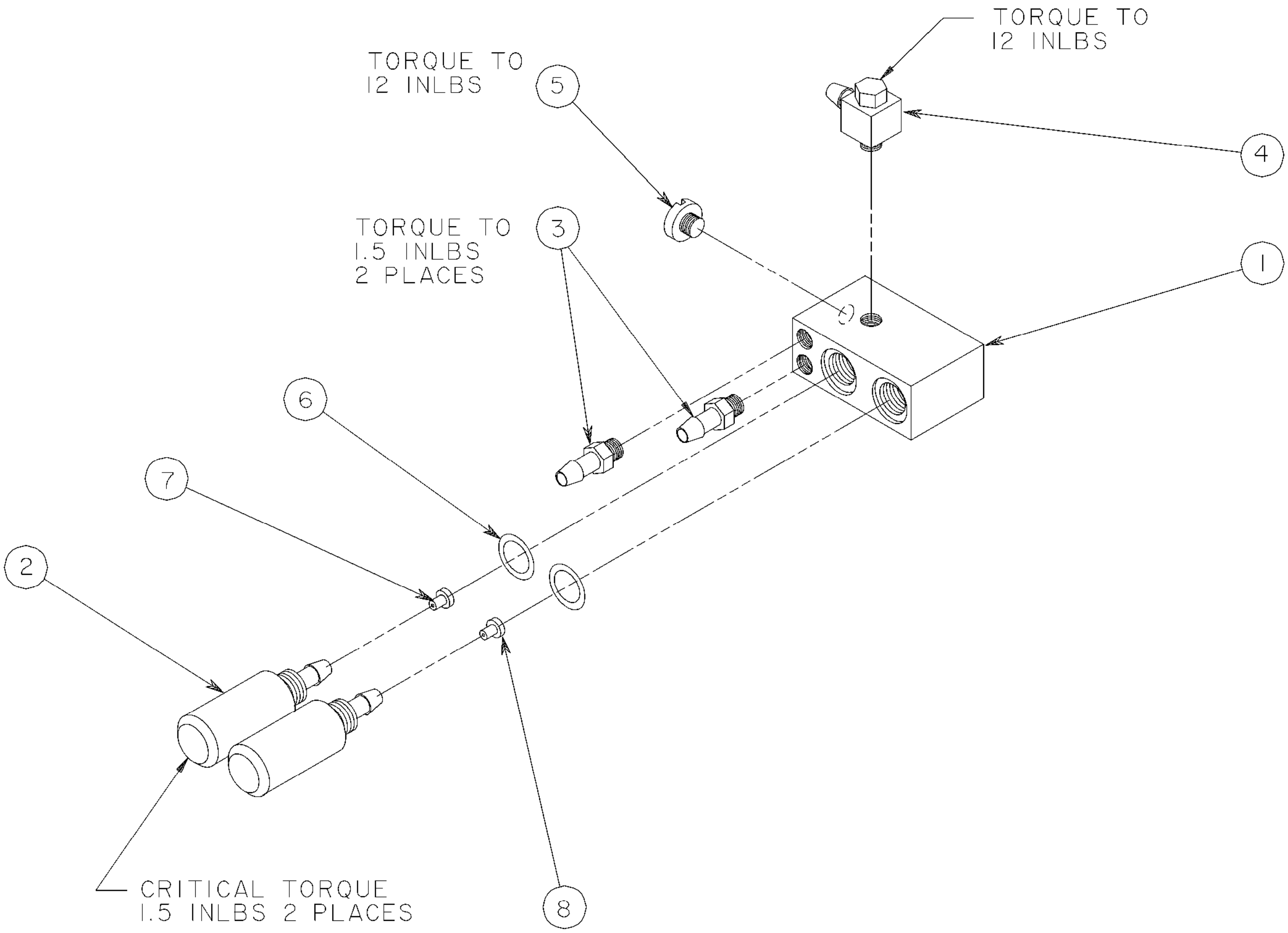

P1
P2
P3
L1
L2
ATM
ATM

PNEUMATIC SCHEMATIC

ATM ATM

PNEUMATIC SCHEMATIC

Exploded View PN 413021-001B/404459-001C


TORQUE TO
12 INLBS
TORQUE TO
12 INLBS
5
4
TORQUE TO
1.5 INLBS
2 PLACES
3
1
6
7
2
CRITICAL TORQUE
1.5 INLBS 2 PLACES
8

Parts List PN 413021-001B/404459-001C

Item	Reference Designation	Parts List	Part Number	Qty
1		Manifold, NBP	404523-001	1
2	V0, V1, W4, W5	Valve, Solenoid -- w/Harness (For PN 413021-001 Only)	413024-001	2
2	V0, V1, W4, W5	Valve, Solenoid -- w/Harness (For PN 404459-001 Only)	700040-001	2
3		Fitting, Adapter, 10-32 to 1/8-Inch ID	4745-201	2
4		Fitting, Adapter, 90°, 10-32 to 1/8-Inch ID	404635-001	1
5		Plug, Brass, 10-32	404674-001	1
6		O-Ring, 0.301-Inch ID	404740-002	2
7		Restrictor, 0.06/0.063 (Black)	404637-002	1
8		Restrictor, 0.03/0.033 (White)	404637-001	1
9		Sealant, Loctite 92	4851-048	AR

For your notes

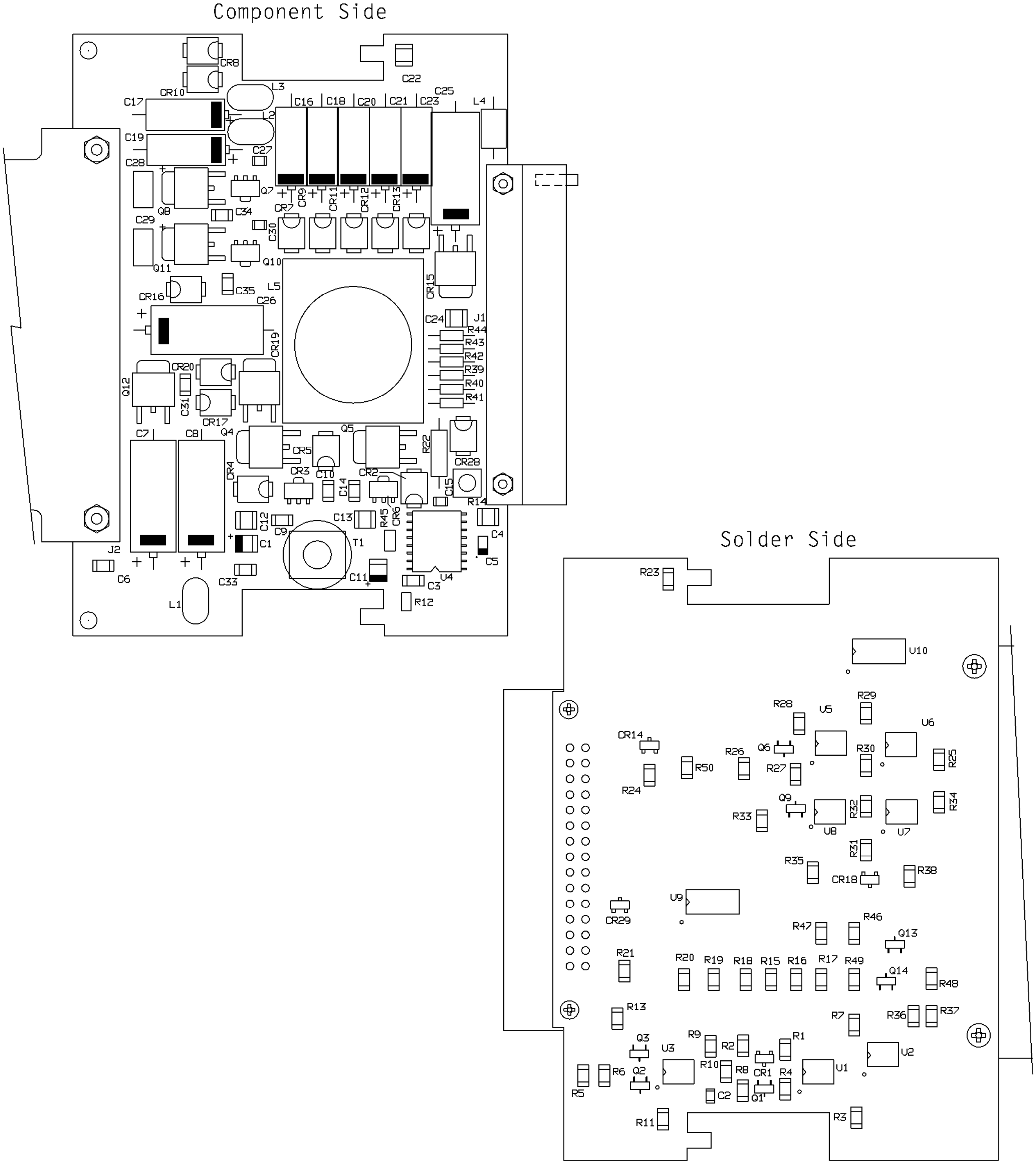
22 POWER SUPPLY ASSEMBLY PN 401309

Location Diagram PN 401309-002J 22-2

Parts List PN 401309-002J 22-3

Schematic Diagram PN 401309-001F 22-5

Parts Location Diagram PN 401309-002J


Component Side
CR8
CR10
L3
C22
C17
C16
C18
C20
C21
C23
C25
L4
L2
C19
C27
C28
Q7
Q8
CR9
CR11
CR12
CR13
C34
CR7
C29
C30
Q10
Q11
L5
CR15
C35
CR16
C26
C24
J1
R44
R43
R42
R39
R40
R41
CR19
CR20
Q12
C31
CR17
C7
C8
Q4
Q5
R22
CR28
CR4
CR5
CR3
C10
CR2
C14
C15
R14
C12
C13
R45
CR6
C4
C9
C1
T1
C5
J2
C11
U4
C3
C6
C33
R12
L1
Solder Side
R23
U10
R28
R29
U5
U6
CR14
Q6
R26
R30
R25
R50
R27
R24
Q9
R33
R32
R34
U8
U7
R31
R35
CR18
R38
U9
CR29
R47
R46
Q13
R21
R20
R19
R18
R15
R16
R17
R49
Q14
R48
R13
R7
R36
R37
Q3
R9
R2
R1
U3
U2
R10
R8
CR1
R4
U1
R6
Q2
R5
C2
Q1
R11
R3

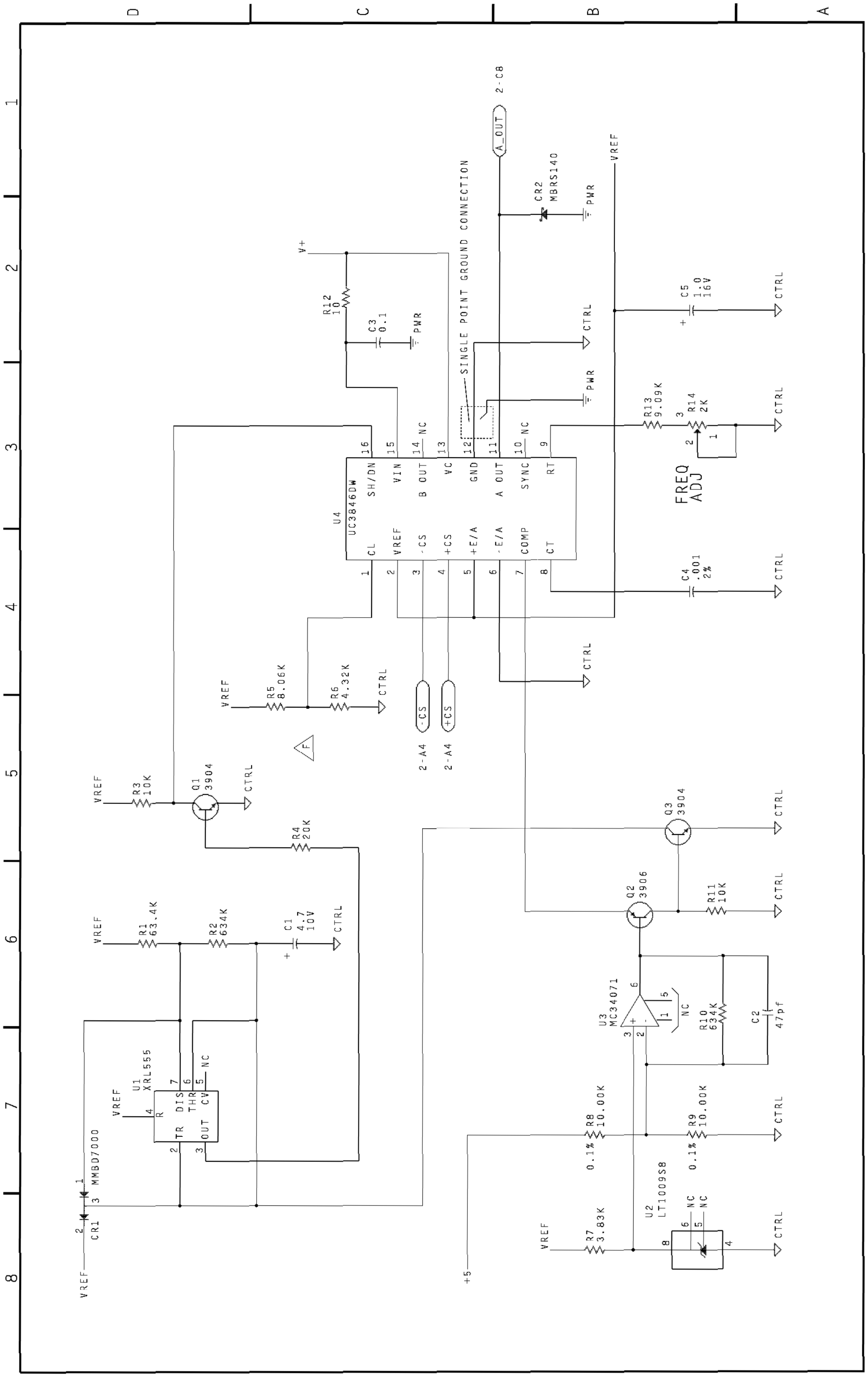
Parts List PN 401309-002J

Item	Parts List	Part Number	Qty
C1, 11	Cap, Tant, 4.7µF, 20%, 10V, SM	1176-475	2
C2	Cap, Cer, 47pF, 5%, 50V, SM	1181-470	1
C3, 6, 9, 10, 14, 31, 33, 34, 35	Cap, Cer, 0.1µF, 20%, 50V	404370-001	9
C4	Cap, Cer, 1000pF, 2%, SM	1184-102	1
C5	Cap, Tant, 1µF, 10%, 16V, SM	403253-001	1
C7, 8	Cap, Tant, 47µF, 10%, 20V	1127-476	2
C12, 13	Cap, Cer, 0.0022µF, 5%, 100V, SM	403030-001	2
C15	Cap, Cer, 0.001µF, 5%, 50V, SM	1181-102	1
C16 - 19, 23	Cap, Tant, 27µF, 10%, 20V	1135-276	5
C20, 21	Cap, Tant, 82µF, 10%, 10V	1225-826	2
C22, 24	Cap, Cer, 0.01µF, 10%, 100V, SM	403029-001	2
C25, 26	Cap, Tant, 120µF, 10%, 35V	1124-127	2
C27, 30	Cap, Cer, 470pF, 5%, 50V, SM	1181-471	2
C28, 29	Cap, Tant, 10µF, 20%, 10V, SM	1176-106	2
CR1, 18	Diode Pair, Series, SM D7000	2013-201	2
CR14	Diode, Zener, 16.8V, SM	403937-001	1
CR15, 19	Diode, Schottky, SM MBRD340	403929-001	2
CR16, 28	Transient Voltage Suppressor P6SMB6.8AT1	403189-001	2
CR2, 4, 5, 11, 12	Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3	403187-001	5
CR29	Diode, Schottky, SM BAT54	401985-001	1
CR3, 6	Diode, Zener, SM BZV49C18	403007-001	2
CR7, 9, 13	Diode, Rectifier, 1A, 100V, SM MURS110T3	403190-001	3
CR8, 10	Transorb, 15V, 5%, 600W SM6T15A	403188-001	2
J1	Connector, PC Header, 30-Pin	1865-030	1
J2	Flex Circuit Assembly, Power Supply	404150-001	1
L1, 2, 3	Inductor, Bead	1426-001	3
L4	Ferrite Bead	403921-001	1
L5	Inductor, Coupled	404256-001	1
Q1, 3, 13, 14	Transistor, NPN, SM T3904	2511-001	4
Q2, 6, 9	Transistor, PNP, SM T3906	2511-101	3
Q4, 5	Transistor, MOSFET, N-Channel, SM IRFR024	403047-001	2
Q7	Transistor, NPN, SM BCX56-1	2712-056	1
Q8	Transistor, PNP, SM MJD2955	403930-001	1
Q10	Transistor, PNP, SM BCX53-10	2712-053	1
Q11	Transistor, NPN, SM MJD3055	403931-001	1
Q12	Transistor, MOSFET, P-Channel, SM IRFR9024	403274-001	1
R1	Res, Cer, 63.4K, 1%, 1/8W, SM	1082-808	1
R2, 10	Res, Cer, 634K, 1%, 1/8W, SM	1082-809	2
R3 , 11, 46 - 49	Res, Cer, 10K, 1%, 1/8W, SM	1082-104	6
R4	Res, Cer, 20K, 1%, 1/8W, SM	1082-202	1

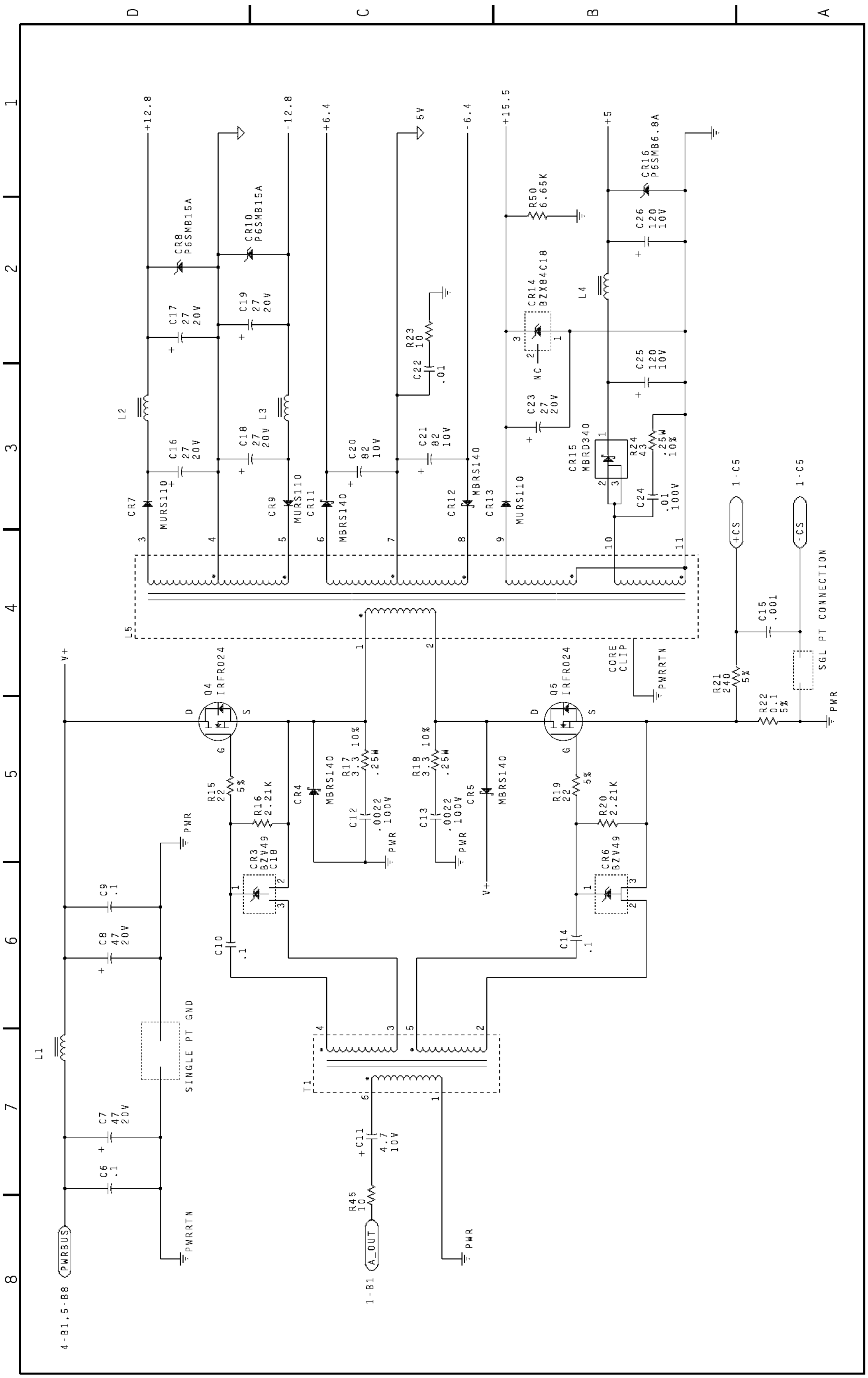
Item	Parts List	Part Number	Qty
R5	Res, Cer, 8.06K, 10%, 1/4W, SM	1082-920	1
R6	Res, Cer, 4.32K, 1%, 1/8W, SM	1082-876	1
R7, 25, 34	Res, Cer, 3.83K, 1%, 1/8W, SM	1082-810	3
R8, 9, 29 - 32	Res, Cer, 10K, 0.1%, 1/8W, SM	1067-834	6
R12, 23, 45	Res, Cer, 10Ω, 1%, 1/8W, SM	1082-786	3
R13	Res, Cer, 9.09K, 1%, 1/8W, SM	1082-814	1
R14	Res, Var, 2K, Top Adjust	403938-001	1
R15, 19	Res, Cer, 22Ω, 5%, 1/8W, SM	1081-220	2
R16, 20	Res, Cer, 2.21K, 1%, 1/8W, SM	1082-787	2
R17, 18	Res, Cer, 3.3Ω, 10%, 1/4W, SM	403026-001	2
R21	Res, Cer, 240Ω, 5%, 1/8W, SM	1081-471	1
R22	Res, WW, 0.1Ω, 5%, 1/2W	1017-003	1
R24	Res, Cer, 43Ω, 10%, 1/4W, SM	403025-001	1
R26	Res, 340Ω, 1%, 1/8W, SM	1082-790	1
R27, 35, 38	Res, Cer, 1K, 1%, 1/8W, SM	1082-103	3
R28, 33	Res, Cer, 15Ω, 1%, 1/8W, SM	1082-811	2
R36	Res, Cer, 5.11K, 1%, 1/8W, SM	1082-784	1
R37	Res, Cer, 100K, 1%, 1/8W, SM	1082-100	1
R39 - 44	Res, Comp, 100Ω, 5%, 1/8W	1000-101	6
R50	Res, Cer, 6.65K, 1%, 1/8W, SM	1082-850	1
T1	Transformer, SM	403106-001	1
U1	Timer, SM XR-L555	403927-001	1
U2, 6, 7	Diode, Regulator, SM LT1009S8	403928-001	3
U3, 5, 8	Operational Ampl, Single Supply, SM MC34071	403926-001	3
U4	Pulse Width Modulator, SM UC3846	402990-001	1
U9, 10	Diode Array, SM MMAD130	403957-001	2
-	Adhesive, Permalok	4851-079	AR
-	Key, Polarizing (for J1)	1865-999	1
-	Heat Shrink Tubing (for L1, 2, 3)	404747-001	AR
-	Screw, PNH, Phillips, SST, 2-56 x 11/32 (for J1)	4502-211	2
-	Screw, PNH, Phillips, SST, 4-40 x 3/8 (for J2)	4502-412	2
-	Nut, Hex, 2-56 (for J1)	4521-102	2
-	Nut, Hex, 4-40 (for J2)	4521-304	2
-	Washer, Nylon, No 4 (for J2)	4550-013	2
-	Circuit Board	401309-001E	1
-	Schematic Diagram	401309-003F	REF

Schematic Diagram PN 401309-001F

1 of 5


D
C
B
A
1
2
3
4
5
6
7
8
U4
UC3846DW
SH/DN
VIN
B OUT
VC
GND
A OUT
SYNC
RT
CL
VREF
-CS
+CS
+E/A
-E/A
COMP
CT
NC
SINGLE POINT GROUND CONNECTION
A_OUT
2-C8
CR2
MBRS140
PWR
VREF
V+
R12
10
C3
0.1
CTRL
C5
1.0
16V
R13
9.09K
R14
2K
FREQ
ADJ
C4
.001
2%
R5
8.06K
R6
4.32K
-CS
+CS
2-A4
F
R3
10K
Q1
3904
R4
20K
Q3
3904
Q2
3906
R11
10K
R1
63.4K
R2
634K
C1
4.7
10V
U3
MC34071
R10
634K
C2
47pf
U1
XRL555
DIS
THR
CV
TR
OUT
R8
10.00K
0.1%
R9
10.00K
U2
LT1009S8
MMBD7000
CR1
R7
3.83K
+5

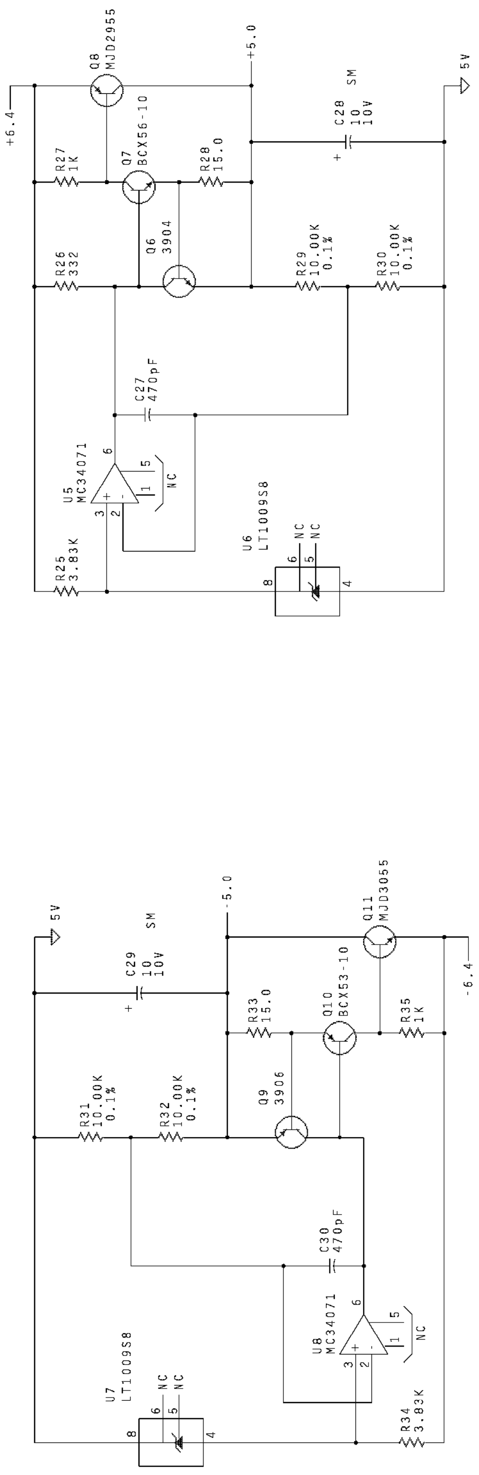
2 of 5


D
C
B
A
1
2
3
4
5
6
7
8
+12.8
-12.8
+6.4
5V
-6.4
+15.5
+5
CR8
P6SMB15A
CR10
P6SMB15A
CR16
P6SMB6.8A
R50
6.65K
C26
120
10V
CR14
BZX84C18
L4
C17
27
20V
C19
27
20V
R23
10
C22
.01
NC
C25
120
10V
L2
L3
C16
27
20V
C18
27
20V
C20
82
10V
C21
82
10V
C23
27
20V
CR15
MBRD340
R24
43
.25W
10%
C24
.01
100V
CR7
MURS110
CR9
MURS110
CR11
MBRS140
CR12
MBRS140
CR13
MURS110
1-C5
+CS
-CS
L5
CORE
CLIP
PWRRTN
C15
.001
SGL PT CONNECTION
R21
240
5%
R22
0.1
5%
PWR
V+
Q4
IRFR024
Q5
IRFR024
D
G
S
R17
3.3 10%
.25W
R18
3.3 10%
.25W
R15
22
5%
R16
2.21K
CR4
MBRS140
CR5
MBRS140
C12
.0022
100V
C13
.0022
100V
R19
22
5%
R20
2.21K
CR3
BZV49
C18
CR6
BZV49
C9
.1
C8
47
20V
C10
.1
C14
.1
L1
SINGLE PT GND
T1
C7
47
20V
C6
.1
C11
4.7
10V
R45
10
PWRBUS
A_OUT
4-B1.5-B8
1-B1
PWRRTN
PWR

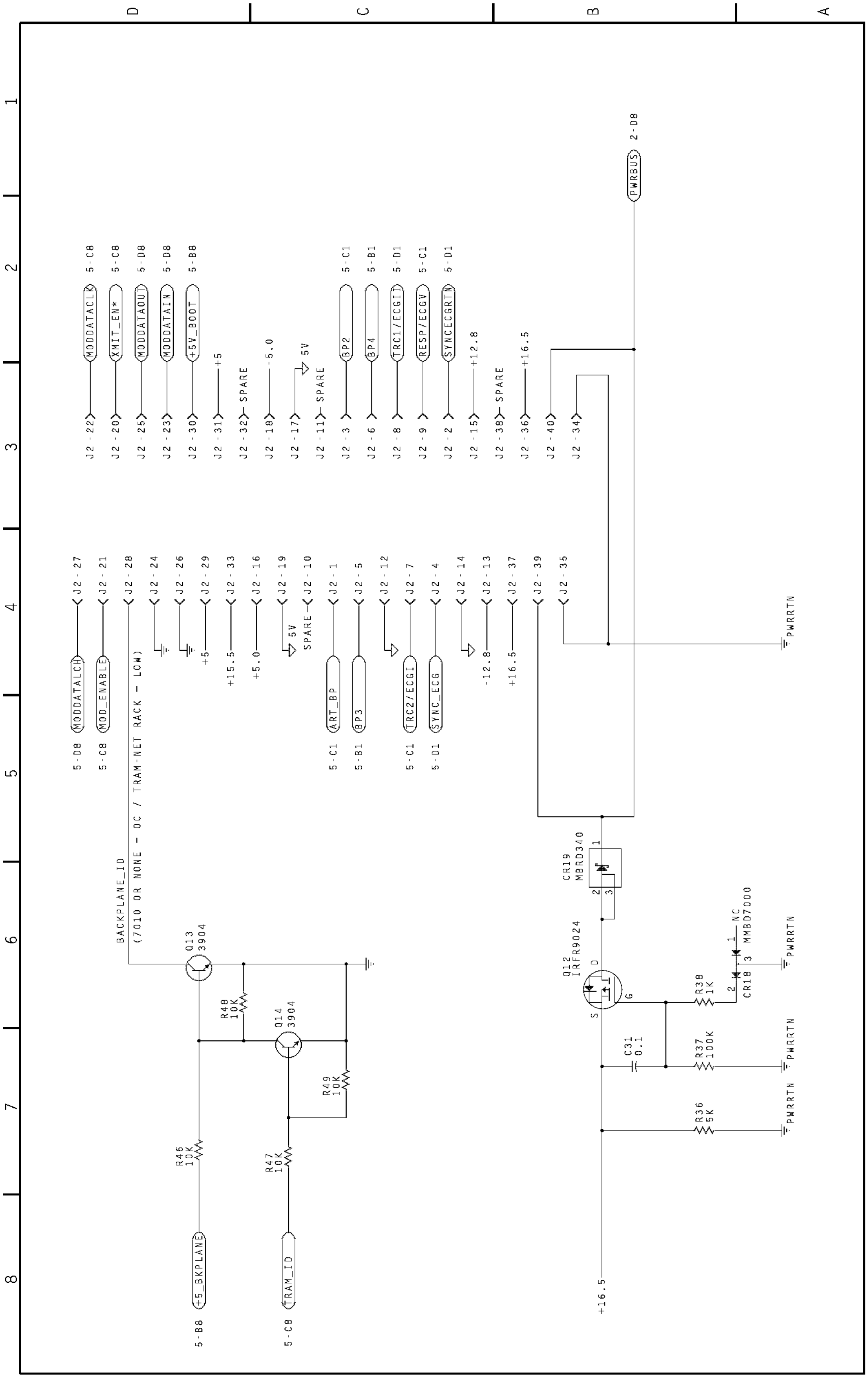
3 of 5

IC POWER/RETURN CHART					
IC		POWER		RETURN	
U1	XRL555	8	VREF	1	
U3	MC34071	7	VREF	4	
U5	MC34071	7	+6.4	4	
U8	MC34071	7	5VAGND	4	
U9	MMAD130	3,11	+5V_BOOT	2,12	
U10	MMAD130	3,11	+12.8	2,12	

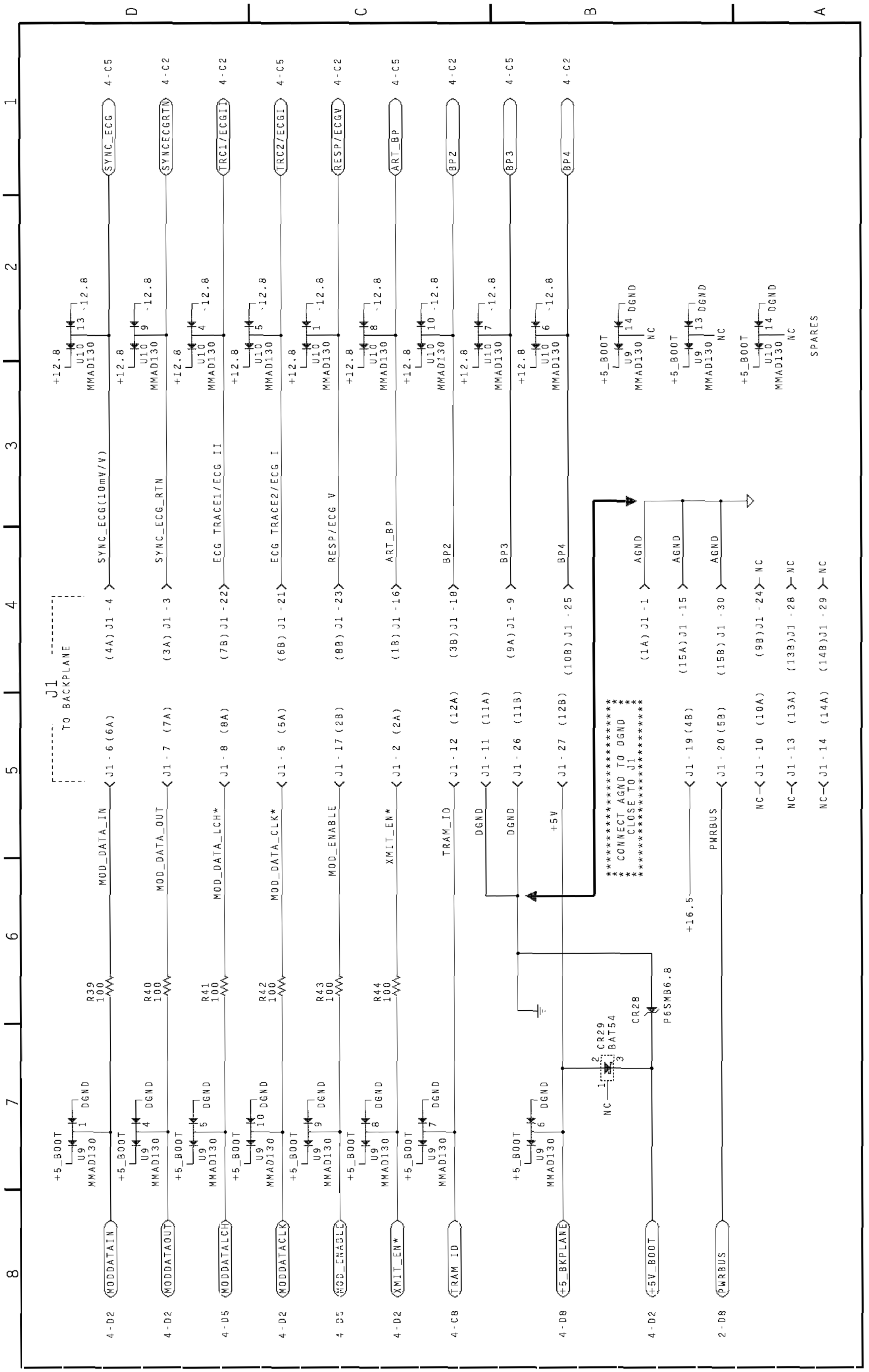
POWER SUPPLY BYPASS	
C33	0.1
C34	0.1
C35	0.1


D
C
B
A
1
2
3
4
5
6
7
8
+6.4
Q8 MJD2955
+5.0
5V
C28 10 10V SM
R27 1K
Q7 BCX56-10
R28 15.0
R26 332
Q6 3904
R29 10.00K 0.1%
R30 10.00K 0.1%
C27 470pF
U5 MC34071
6
5
1
2
3
NC
U6 LT1009S8
NC
NC
8
6
5
4
5V
C29 10 10V SM
-5.0
Q11 MJD3055
-6.4
R33 15.0
Q10 BCX53-10
R35 1K
R31 10.00K 0.1%
R32 10.00K 0.1%
Q9 3906
C30 470pF
U8 MC34071
NC
U7 LT1009S8
R34 3.83K
R25 3.83K

4 of 5


D
C
B
A
1
2
3
4
5
6
7
8
MODDATACLK 5-C8
XMIT_EN* 5-C8
MODDATAOUT 5-D8
MODDATAIN 5-D8
+5V_BOOT 5-B8
+5
SPARE
-5.0
5V
SPARE
BP2 5-C1
BP4 5-B1
TRC1/ECGI1 5-D1
RESP/ECGV 5-C1
SYNCECGRTN 5-D1
+12.8
SPARE
+16.5
PWRBUS 2-D8
J2-22
J2-20
J2-25
J2-23
J2-30
J2-31
J2-32
J2-18
J2-17
J2-11
J2-3
J2-6
J2-8
J2-9
J2-2
J2-15
J2-38
J2-36
J2-40
J2-34
J2-27
J2-21
J2-28
J2-24
J2-26
J2-29
J2-33
J2-16
J2-19
J2-10
J2-1
J2-5
J2-12
J2-7
J2-4
J2-14
J2-13
J2-37
J2-39
J2-35
MODDATALCH 5-D8
MOD_ENABLE 5-C8
+5
+15.5
+5.0
5V
SPARE
ART_BP 5-C1
BP3 5-B1
TRC2/ECGI 5-C1
SYNC_ECG 5-D1
-12.8
+16.5
PWRRTN
BACKPLANE_ID
(7010 OR NONE = OC / TRAM-NET RACK = LOW)
Q13 3904
R48 10K
Q14 3904
R49 10K
R46 10K
R47 10K
+5_BKPLANE 5-B8
TRAM_ID 5-C8
CR19 MBRD340
1
2
3
Q12 IRFR9024
D
G
S
NC
1
2
3
CR18 MMBD7000
R38 1K
PWRRTN
C31 0.1
R37 100K
PWRRTN
R36 5K
PWRRTN
+16.5

5 of 5


D
C
B
A
1
2
3
4
5
6
7
8
SYNC_ECG
SYNCECGRTN
TRC1/ECGII
TRC2/ECGI
RESP/ECGV
ART_BP
BP2
BP3
BP4
4-C5
4-C2
U10
MMAD130
+12.8
-12.8
+5_BOOT
U9
DGND
NC
SPARES
SYNC_ECG(10mV/V)
SYNC_ECG_RTN
ECG TRACE1/ECG II
ECG TRACE2/ECG I
RESP/ECG V
ART_BP
AGND
J1
TO BACKPLANE
(4A)J1-4
(3A)J1-3
(7B)J1-22
(6B)J1-21
(8B)J1-23
(1B)J1-16
(3B)J1-18
(9A)J1-9
(10B)J1-25
(1A)J1-1
(15A)J1-15
(15B)J1-30
(9B)J1-24
(13B)J1-28
(14B)J1-29
J1-6(6A)
J1-7 (7A)
J1-8 (8A)
J1-5 (5A)
J1-17(2B)
J1-2 (2A)
J1-12 (12A)
J1-11 (11A)
J1-26 (11B)
J1-27 (12B)
J1-19(4B)
J1-20(5B)
J1-10 (10A)
J1-13 (13A)
J1-14 (14A)
CONNECT AGND TO DGND
CLOSE TO J1
MOD_DATA_IN
MOD_DATA_OUT
MOD_DATA_LCH*
MOD_DATA_CLK*
MOD_ENABLE
XMIT_EN*
TRAM_ID
+5V
PWRBUS
+16.5
R39
R40
R41
R42
R43
R44
100
CR28
P6SMB6.8
CR29
BAT54
MODDATAIN
MODDATAOUT
MODDATALCH
MODDATACLK
MOD_ENABLE
XMIT_EN*
TRAM_ID
+5_BKPLANE
+5V_BOOT
PWRBUS
4-D2
4-D5
4-C8
4-D8
2-D8

For your notes

23

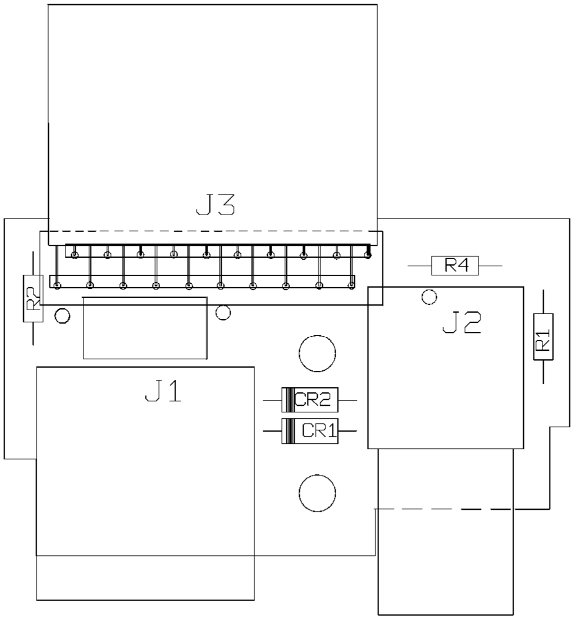
NON-ISOLATED INPUT PCB PN 401315

Parts Location Diagram PN 401315-003D 23-2

Parts List PN 401315-003D 23-3

Schematic Diagram PN 401315-003D 23-4

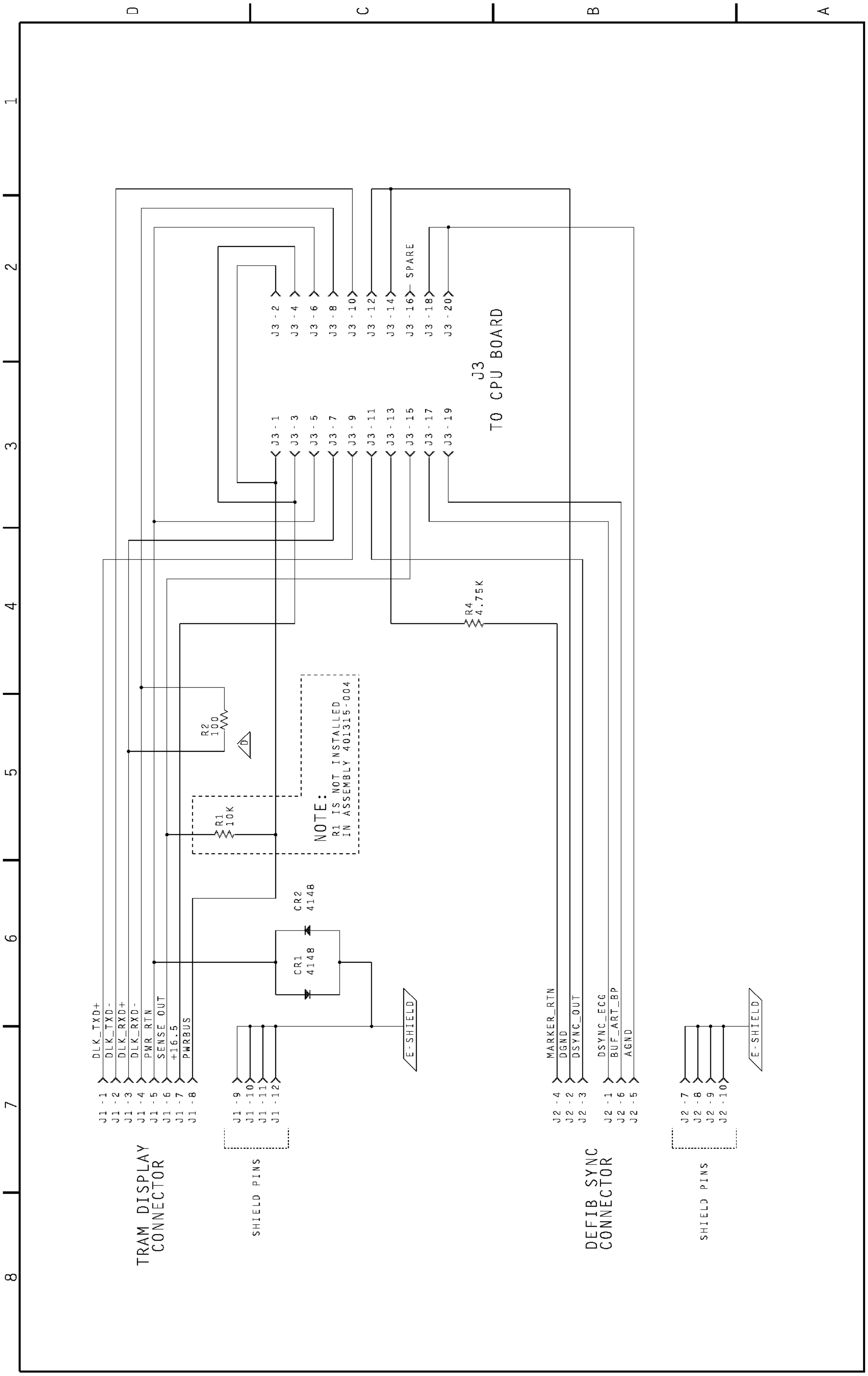
Parts Location Diagram PN 401315-003D


J3
R4
R2
J2
R1
J1
CR2
CR1

Parts List PN 401315-003D

Item	Parts List	Part Number	Qty
CR1, 2	Diode 1N4148	2004-148	2
J1	Conneector, Receptacle 12-Pin	403934-001	1
J2	Connector, Receptacle, 6-Pin	403933-001	1
J3	Flex Circuit Assembly	404149-001	1
R1	Res, MF, 10.0K, 1%, 1/4W	1023-287	1
R2	Res, MF, 100Ω, 1%, 1/4W	1023-096	1
R4	Res, MF, 4.75K, 1%, 1/4W	1023-256	1
-	Insulator (Used between J3 and circuit board.)	404608-001	1
-	Circuit Board	401315-001	1
-	Schematic Diagram	401315-003D	REF

Schematic Diagram PN 401315-003D


D
C
B
A
1
2
3
4
5
6
7
8
J3
TO CPU BOARD
J3 - 2
J3 - 4
J3 - 6
J3 - 8
J3 - 10
J3 - 12
J3 - 14
J3 - 16
J3 - 18
J3 - 20
SPARE
J3 - 1
J3 - 3
J3 - 5
J3 - 7
J3 - 9
J3 - 11
J3 - 13
J3 - 15
J3 - 17
J3 - 19
R4
4.75K
R2
100
D
R1
10K
NOTE:
R1 IS NOT INSTALLED
IN ASSEMBLY 401315-004
CR2
4148
CR1
4148
E-SHIELD
DLK_TXD+
DLK_TXD-
DLK_RXD+
DLK_RXD-
PWR_RTN
SENSE_OUT
+16.5
PWRBUS
J1 - 1
J1 - 2
J1 - 3
J1 - 4
J1 - 5
J1 - 6
J1 - 7
J1 - 8
J1 - 9
J1 - 10
J1 - 11
J1 - 12
TRAM DISPLAY
CONNECTOR
SHIELD PINS
MARKER_RTN
DGND
DSYNC_OUT
DSYNC_ECG
BUF_ART_BP
AGND
J2 - 4
J2 - 2
J2 - 3
J2 - 1
J2 - 6
J2 - 5
J2 - 7
J2 - 8
J2 - 9
J2 - 10
E-SHIELD
DEFIB SYNC
CONNECTOR
SHIELD PINS

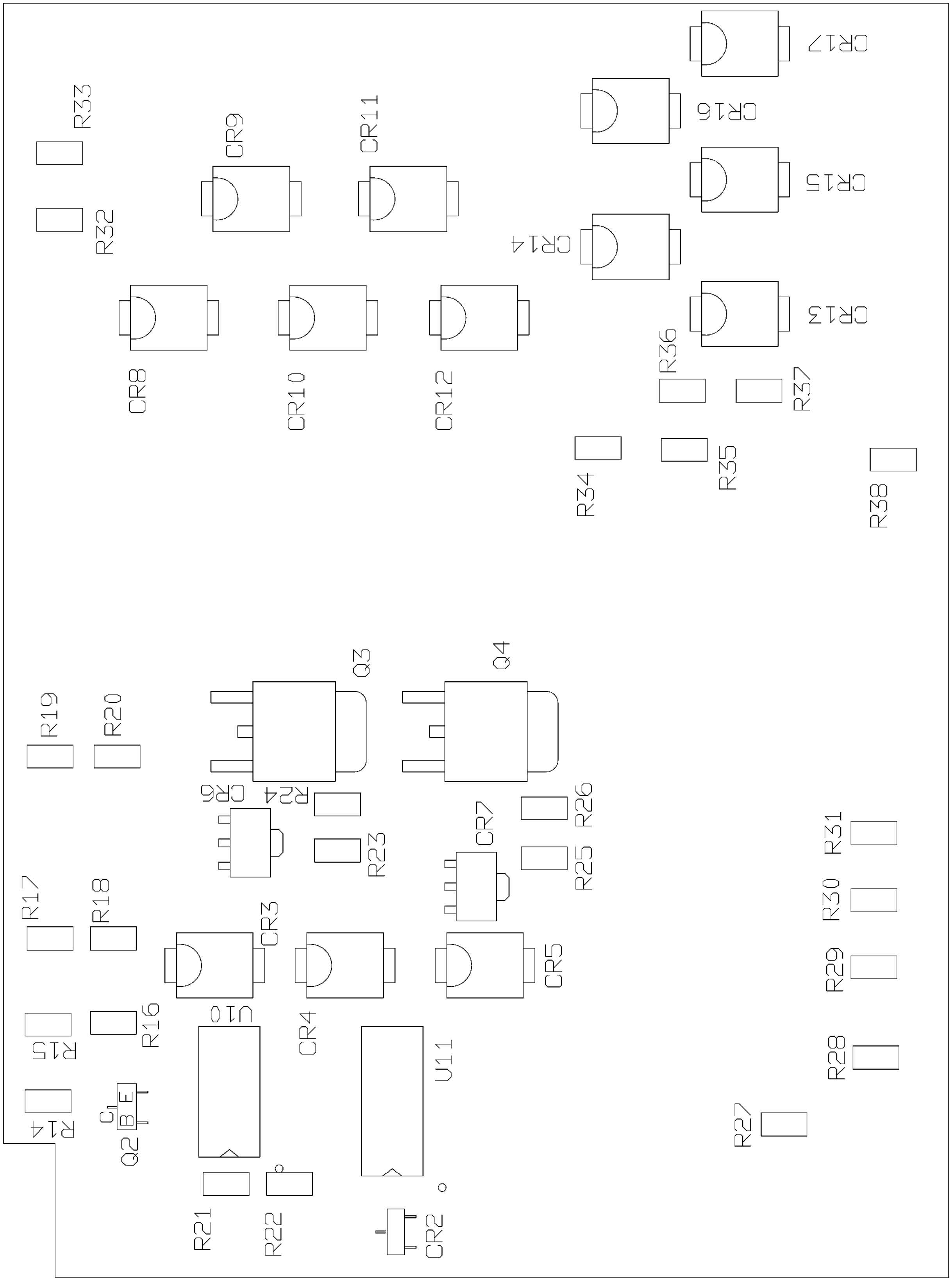
24 ISOLATED POWER SUPPLY PN 402329

Parts Location Diagram PN 402329-002N 24-2

Parts List PN 402329-002N 24-3

Schematic Diagram PN 402329-002N 24-5

Parts Location Diagram PN 402329-002N


CR17
R33
CR9
CR11
CR16
CR15
R32
CR14
CR13
CR8
CR10
CR12
R36
R37
R34
R35
R38
Q3
Q4
R19
R20
CR6
R24
R26
R23
CR7
R31
R25
R17
R18
CR3
R30
CR5
R29
U10
R16
R15
CR4
U11
R28
C
B
E
R27
Q2
R14
R21
R22
CR2

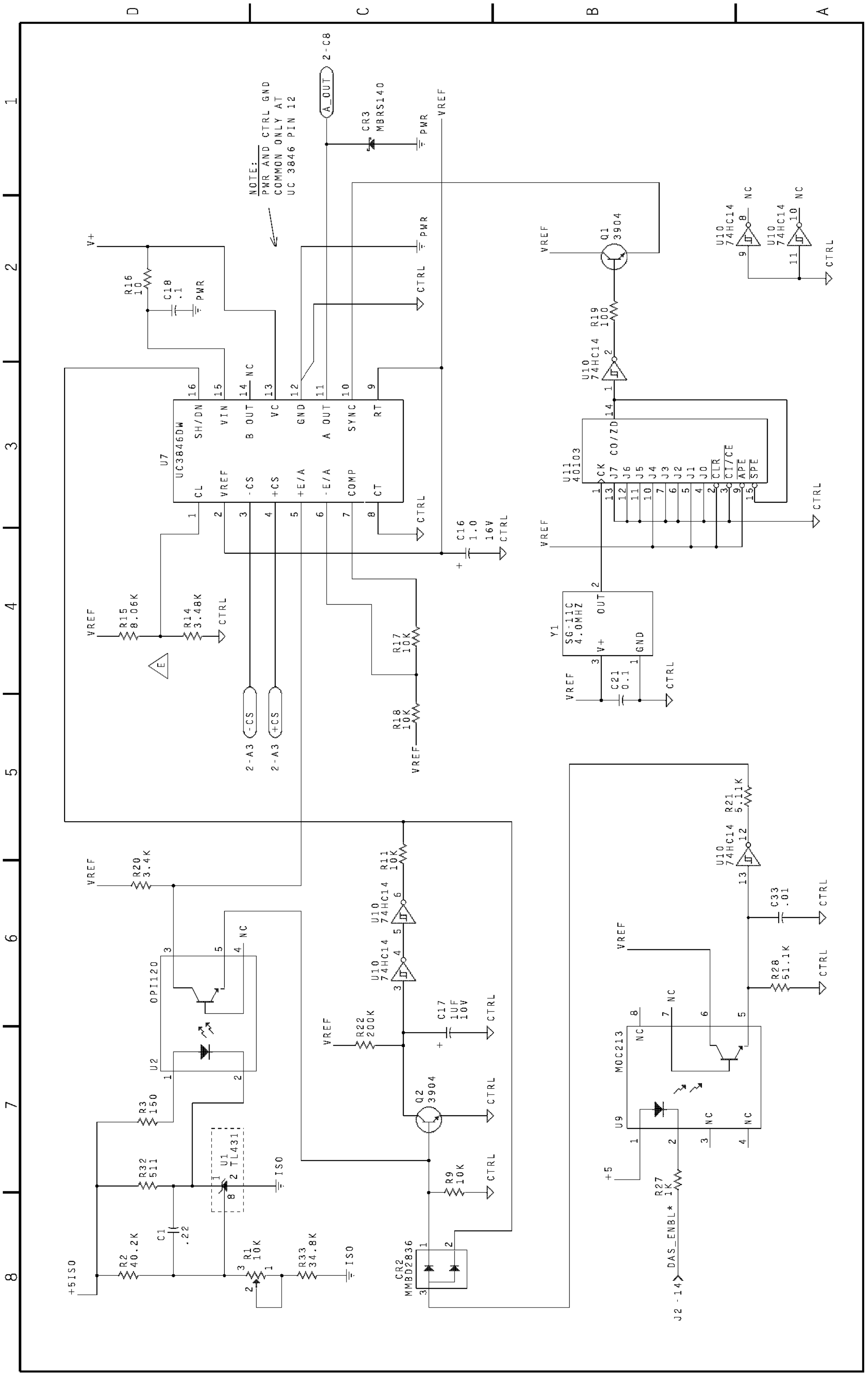
Parts List PN 402329-002N

Item	Parts List	Part Number	Qty
C1	Cap, Cer, 0.22µF, 20%, 50V, SM	1187-224	1
C2, 3, 4, 10, 11, 12	Cap, Tant, 82µF, 10%, 10V	1225-826	6
C5	Cap, Cer, 0.01µF, 10%, 100V, SM	403029-001	1
C6 - 9	Cap, Tant, 27µF, 10%, 20V	1135-276	4
C13	Cap, Cer, 270pF, 5%, 50V, SM	1181-271	1
C14, 18, 21, 22, 25, 27, 29, 30, 32	Cap, Cer, 0.1µF, 20%, 50V	404370-001	9
C15, 31	Cap, Cer, 100pF, 5%, 50V, SM	1181-101	2
C16, 17	Cap, Tant, 1µF, 10%, 16V, SM	403253-001	2
C19	Cap, Cer, 0.001µF, 5%, 50V, SM	1181-102	1
C20	Cap, Tant, 4.7µF, 20%, 10V, SM	1176-475	1
C23, 24	Cap, Cer, 0.0022µF, 5%, 100V, SM	403030-001	2
C26, 28	Cap, Tant, 47µF, 10%, 20V	1127-476	2
C33	Cap, Cer, 0.01µF, 5%, 50V, SM	1182-103	1
CR1	Diode Pair, Series, SM D7000	2013-201	1
CR2	Diode Pair, Common Anode, SM D2836	402544-001	1
CR3, 4, 5, 8, 9, 10	Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3	403187-001	6
CR6, 7	Diode, Zener, SM BZV49C18	403007-001	2
CR11, 12	Diode, Rectifier, 1A, 100V, SM MURS110T3	403190-001	2
CR13, 14, 15	Diode, Transient Voltage Suppressor, 5V, 600W P6SMB6.8AT1	403189-001	3
CR16, 17	Transorb, 15V, 5%, 600W SM6T15A	403188-001	2
E1	Surge Protector, 7.5kV, 15%	1931-001	1
E2	Surge Protector, 90V	1931-101	1
J1	Connector, Vertical, 16-Pin	1847-016	1
J2	Connector, Vertical, 14-Pin	1847-014	1
L1 - 4	Inductor, Bead	1426-001	4
L5	Inductor, Coupled, Critical Component	403281-001	1
L6	Choke, Common Mode, SM	403105-001	1
Q1, 2	Transistor, NPN, SM T3904	2511-001	2
Q3, 4	Transistor, MOSFET, N-Channel, SM IRFR024	403047-001	2
R1	Res, Var, 10K, Top-Adjust	403282-001	1
R2	Res, Cer, 40.2K, 10%, 1/4W, SM	1082-792	1
R3	Res, Cer, 150Ω, 1%, 1/8W, SM	1082-767	1
R4	Res, Cer, 43Ω, 10%, 1/4W, SM	403025-001	1
R5, 6, 9, 11, 17, 18, 30	Res, Cer, 10K, 1%, 1/8W, SM	1082-104	7
R7	Res, WW, 0.1Ω, 5%, 1/2W	1017-003	1
R8	Res, Cer, 240Ω, 5%, 1/8W, SM	1081-471	1
R10, 12	Res, Cer, 3.3Ω, 10%, 1/4W, SM	403026-001	2
R13, 34, 38	Res, 340Ω, 1%, 1/8W, SM	1082-790	3
R14	Res, Cer, 3.48K, 10%, 1/4W, SM	1082-919	1

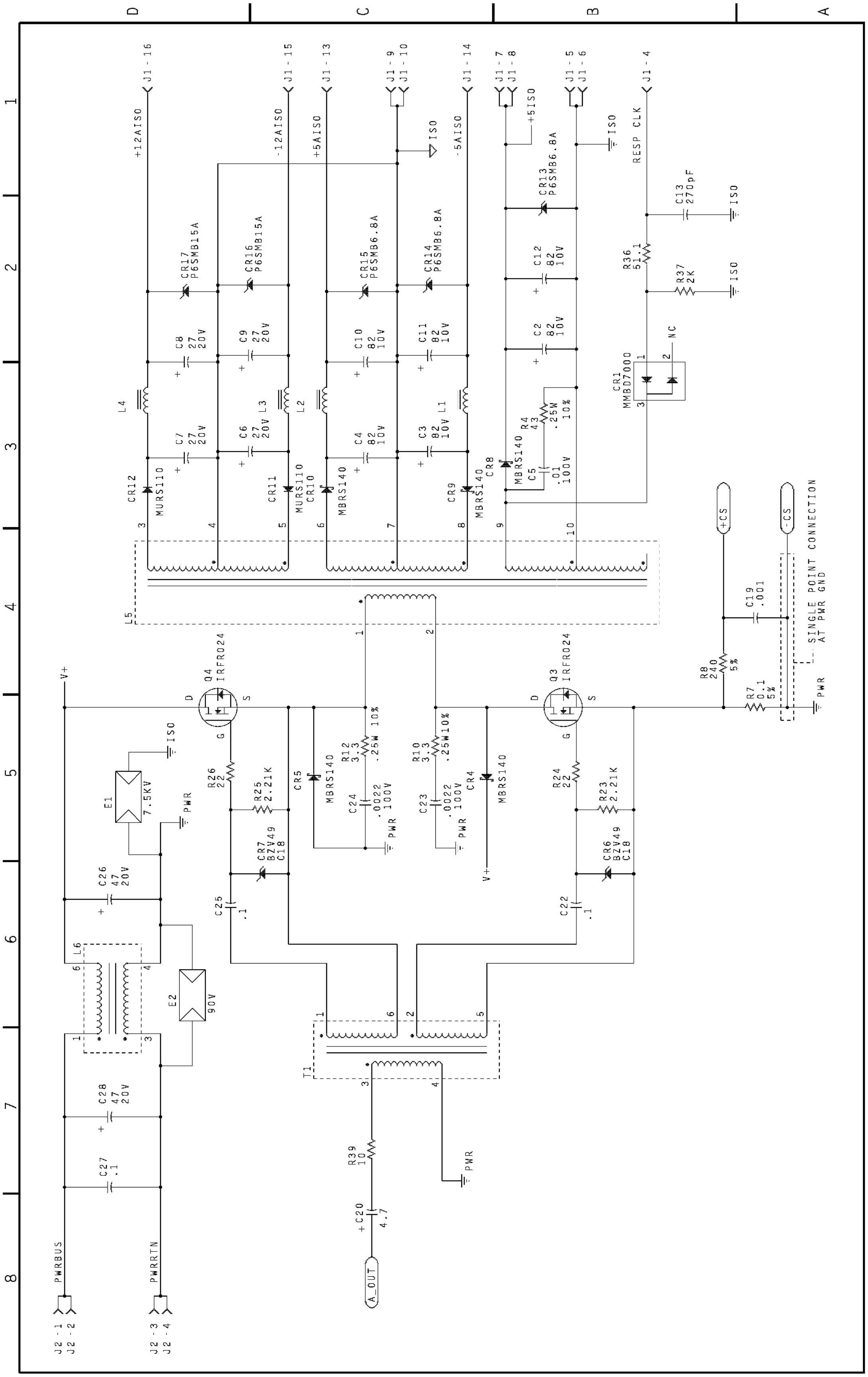
Item	Parts List	Part Number	Qty
R15	Res, Cer, 8.06K, 10%, 1/4W, SM	1082-920	1
R16, 39	Res, Cer, 10Ω, 1%, 1/8W, SM	1082-786	2
R19	Res, Cer, 100Ω, 1%, 1/8W, SM	1082-755	1
R20	Res, Cer, 3.4K, 1%, 1/8W, SM	1082-759	1
R21	Res, Cer, 5.11K, 1%, 1/8W, SM	1082-784	1
R22	Res, Cer, 200K, 1%, 1/8W, SM	1082-200	1
R23, 25	Res, Cer, 2.21K, 1%, 1/8W, SM	1082-787	2
R24, 26	Res, Cer, 22Ω, 5%, 1/8W, SM	1081-220	2
R27	Res, Cer, 1K, 1%, 1/8W, SM	1082-103	1
R28	Res, Cer, 51.1K, 10%, 1/4W, SM	1082-772	1
R29, 31, 35	Res, Cer, 4.75K, 1%, 1/8W, SM	1082-760	3
R32	Res, Cer, 511Ω, 10%, 1/4W, SM	1082-794	1
R33	Res, Cer, 34.8K, 10%, 1/4W, SM	1082-791	1
R36	Res, Cer, 51.1Ω, 10%, 1/4W, SM	1082-789	1
R37	Res, Cer, 2K, 1%, 1/8W, SM	1082-201	1
T1	Transformer, SM	403106-001	1
U1	Volt Rgltr, SM TL431ACD	403046-001	1
U2	Isolator, Optically Coupled OPI120	405050-001	1
U3, 8	Buffer, 3-State Output, Quad, SM HC126	403033-001	2
U4, 5, 6	Isolator, Optically Coupled TLP582	402153-002	3
U7	Pulse Width Modulator, SM UC3846	402990-001	1
U9	Isolator, Optically Coupled, SM MOC213	403040-001	1
U10	Inverter, Schmitt Trigger, Hex, SM HC14	3038-014	1
U11	Counter, Down, Synchronous, 8-Bit, SM HC40103	401432-001	1
Y1	Oscillator, CMOS, 4MHz	402987-001	1
-	Heat Shrink Tubing (Used on L1 - 4)	404747-001	AR
-	Circuit Board	402329-001F	1
-	Schematic Diagram	402329-003E	–

Schematic Diagram PN 402329-002N

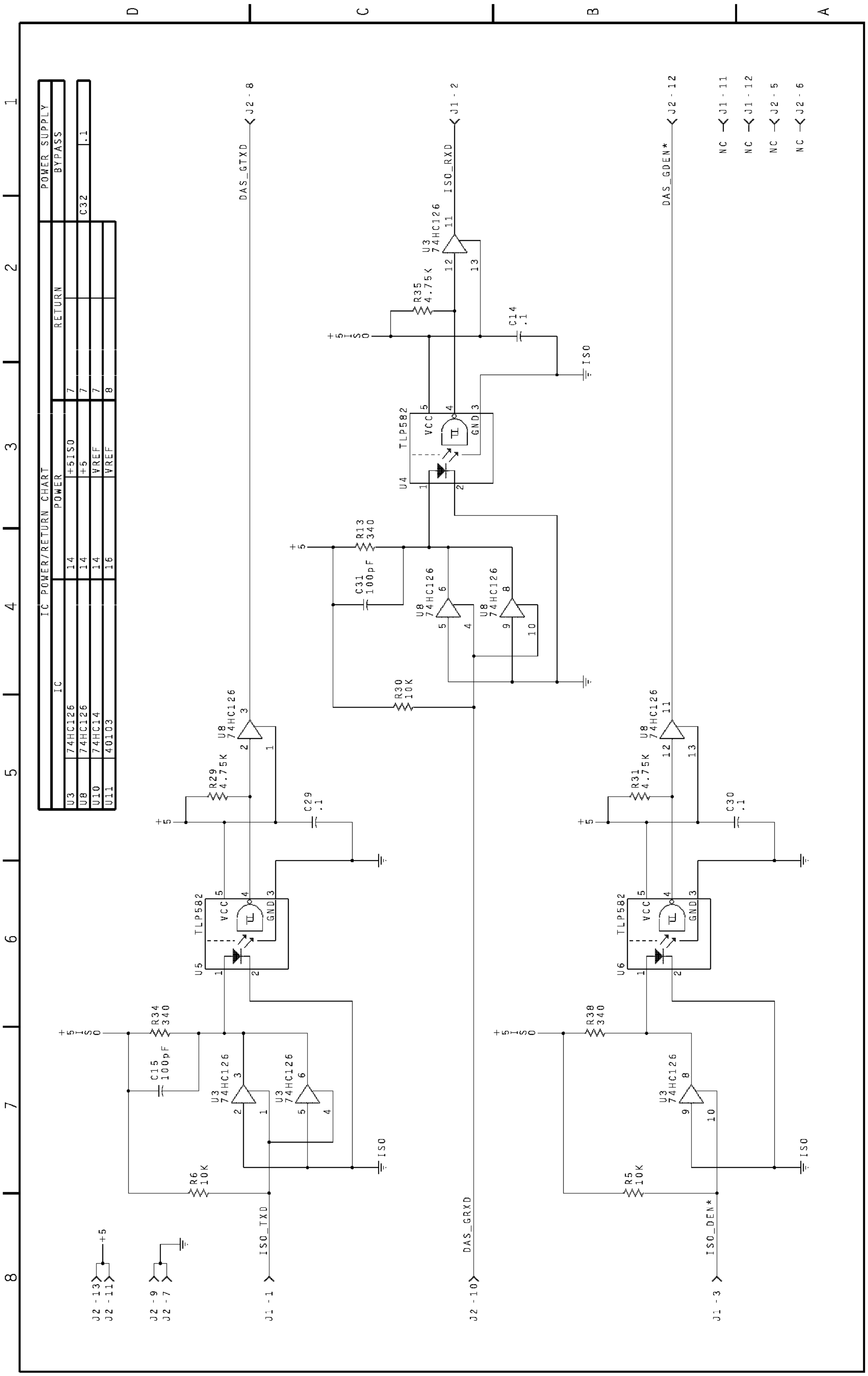
1 of 3


D
C
B
A
1
2
3
4
5
6
7
8
NOTE:
PWR AND CTRL GND
COMMON ONLY AT
UC 3846 PIN 12
A_OUT
2-C8
CR3
MBRS140
PWR
VREF
V+
R16
10
C18
.1
PWR
CTRL
U7
UC3846DW
SH/DN
VIN
B OUT
VC
GND
A OUT
SYNC
RT
CL
VREF
-CS
+CS
+E/A
-E/A
COMP
CT
NC
C16
1.0
16V
R15
8.06K
R14
3.48K
E
-CS
+CS
2-A3
2-A3
R17
10K
R18
10K
Q1
3904
R19
100
U10
74HC14
NC
U11
40103
CK
CO/ZD
J7
J6
J5
J4
J3
J2
J1
J0
CLR
CI/CE
APE
SPE
Y1
SG-11C
4.0MHZ
OUT
V+
GND
C21
0.1
R21
5.11K
C33
.01
R28
51.1K
MOC213
U9
R27
1K
+5
DAS_ENBL*
J2-14
R20
3.4K
OPI120
U2
R3
150
R32
511
U1
TL431
ISO
C1
.22
R2
40.2K
R1
10K
R33
34.8K
+5ISO
R11
10K
R22
200K
C17
1UF
10V
Q2
3904
R9
10K
CR2
MMBD2836

2 of 3


D
C
B
A
1
2
3
4
5
6
7
8
J1 - 16
+12AISO
J1 - 15
-12AISO
J1 - 13
+5AISO
J1 - 9
J1 - 10
ISO
J1 - 14
-5AISO
J1 - 7
J1 - 8
+5ISO
J1 - 5
J1 - 6
ISO
J1 - 4
RESP CLK
CR17 P6SMB15A
CR16 P6SMB15A
CR15 P6SMB6.8A
CR14 P6SMB6.8A
CR13 P6SMB6.8A
C13 270pF
ISO
R36 51.1
R37 2K
ISO
C8 27 20V
C9 27 20V
C10 82 10V
C11 82 10V
C12 82 10V
C2 82 10V
CR1 MMBD7000
NC
L4
L3
L2
L1
C7 27 20V
C6 27 20V
C4 82 10V
C3 82 10V
R4 43 .25W 10%
CR12 MURS110
CR11 MURS110
CR10 MBRS140
CR9 MBRS140
CR8 MBRS140
C5 .01 100V
+CS
-CS
SINGLE POINT CONNECTION AT PWR GND
L5
C19 .001
R8 240 5%
R7 0.1 5%
PWR
V+
Q4 IRFR024
Q3 IRFR024
D
G
S
ISO
E1 7.5KV
PWR
R26 22
R25 2.21K
CR5 MBRS140
R12 3.3 .25W 10%
C24 .0022 100V
PWR
R10 3.3 .25W10%
C23 .0022 100V
PWR
CR4 MBRS140
V+
R24 22
R23 2.21K
CR7 BZV49 C18
CR6 BZV49 C18
C26 47 20V
C25 .1
C22 .1
L6
E2 90V
T1
C28 47 20V
C27 .1
R39 10
PWR
C20 4.7
A_OUT
PWRBUS
PWRRTN
J2 - 1
J2 - 2
J2 - 3
J2 - 4

3 of 3


D
C
B
A
1
2
3
4
5
6
7
8
DAS_GTXD
J2-8
ISO_RXD
J1-2
DAS_GDEN*
J2-12
NC J1-11
NC J1-12
NC J2-5
NC J2-6
U3 74HC126
R35 4.75K
C14 .1
+5ISO
ISO
U4 TLP582
VCC
GND
R13 340
+5
C31 100pF
U8 74HC126
R30 10K
R29 4.75K
C29 .1
U5 TLP582
R34 340
C15 100pF
R6 10K
ISO_TXD
J1-1
DAS_GRXD
J2-10
R31 4.75K
C30 .1
U6 TLP582
R38 340
R5 10K
ISO_DEN*
J1-3
J2-13
J2-11
J2-9
J2-7

IC POWER/RETURN CHART

IC		POWER		RETURN
U3	74HC126	14	+5ISO	7
U8	74HC126	14	+5	7
U10	74HC14	14	VREF	7
U11	40103	16	VREF	8

POWER SUPPLY BYPASS

C32	.1

For your notes

25

POWER INDICATOR PCB PN 403170/800006

Parts Location Diagram PN 403170-008B/009A/011A 25-2

Parts List PN 403170-008B/009A/011A 25-3

Schematic Diagram PN 403170-008B/009A/011A 25-4

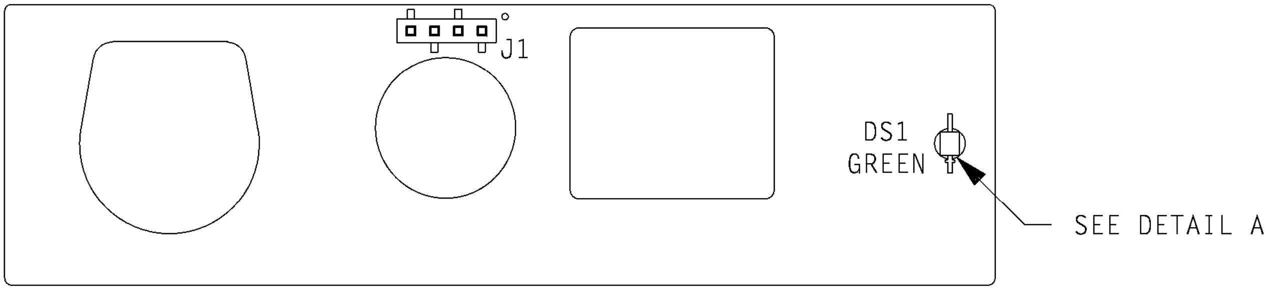
Parts Location Diagram PN 800006-001D 25-5

Parts List PN 800006-001D 25-6

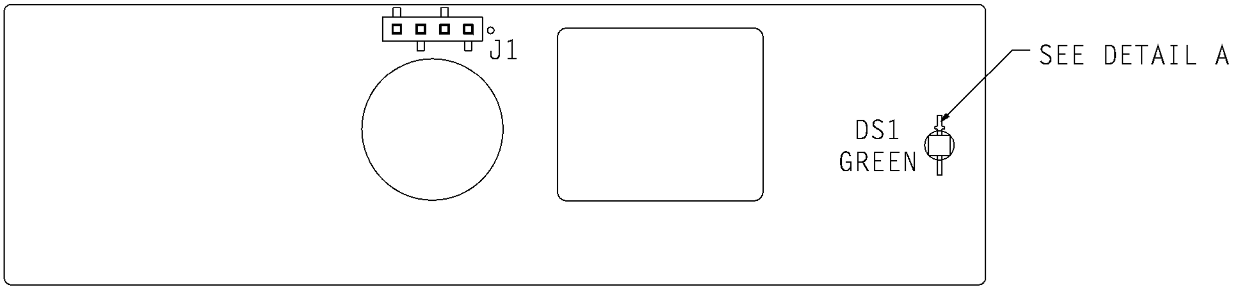
Schematic Diagram PN 800006-001D 25-7

Parts Location Diagram PN 403170-008B/009A/011A

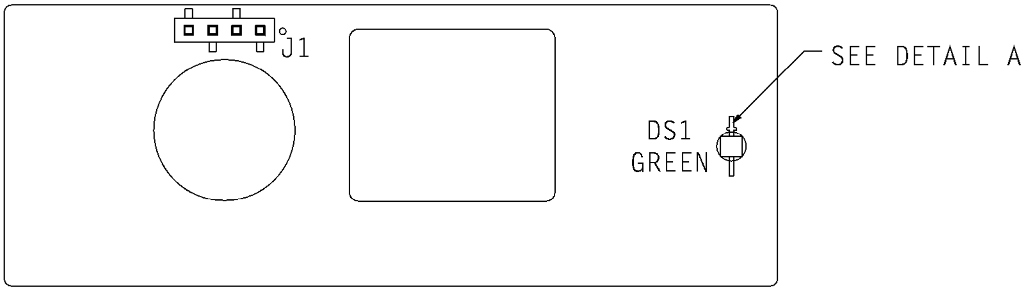
PN 403170-008

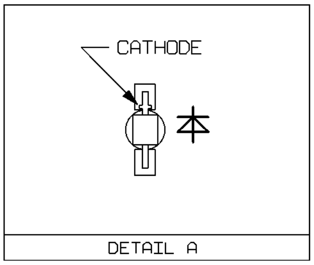

J1
DS1
GREEN
SEE DETAIL A

PN 403170-009


J1
SEE DETAIL A
DS1
GREEN

PN 403170-011

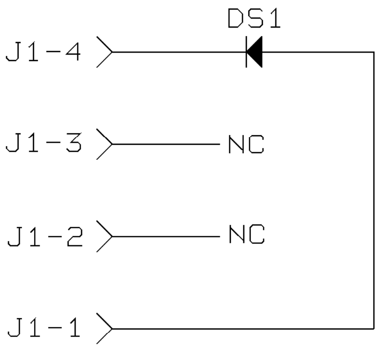

J1
SEE DETAIL A
DS1
GREEN


CATHODE
DETAIL A

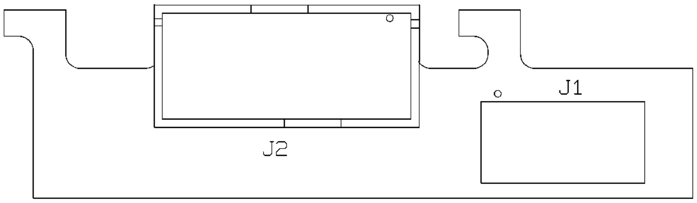
Parts List PN 403170-008B/009A/011A

Item	Parts List	Part Number	Qty
J1	Connector, Male, 4-Pin	405237-002	1
DS1	Diode, Light-Emitting, SM, Green	405033-022	1
-	Circuit Board (Use on PN 403170-008 Only)	403170-005	1
-	Circuit Board (Use on PN 403170-009 Only)	403170-007	1
-	Circuit Board (Use on PN 403170-011 Only)	403170-010	1

Schematic Diagram PN 403170-008B/009A/011A


DS1
J1-4
J1-3
NC
J1-2
NC
J1-1

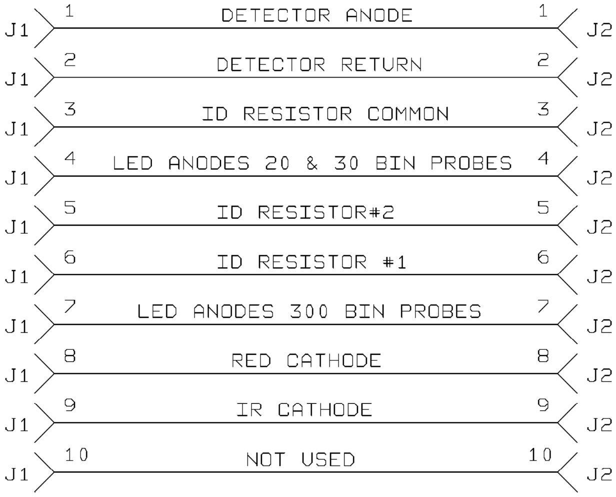
Parts Location Diagram PN 800006-001D



Parts List PN 800006-001D

Item	Parts List	Part Number	Qty
J1	Connector, Vertical, 10-Pin	1847-010	1
J2	Connector, PC Header, 10-Pin	1823-310	1
-	Circuit Board	800007-001	1

Schematic Diagram PN 800006-001D


J1
1
DETECTOR ANODE
1
J2
2
DETECTOR RETURN
2
3
ID RESISTOR COMMON
3
4
LED ANODES 20 & 30 BIN PROBES
4
5
ID RESISTOR#2
5
6
ID RESISTOR #1
6
7
LED ANODES 300 BIN PROBES
7
8
RED CATHODE
8
9
IR CATHODE
9
10
NOT USED
10

For your notes

26

FAN ASSEMBLY

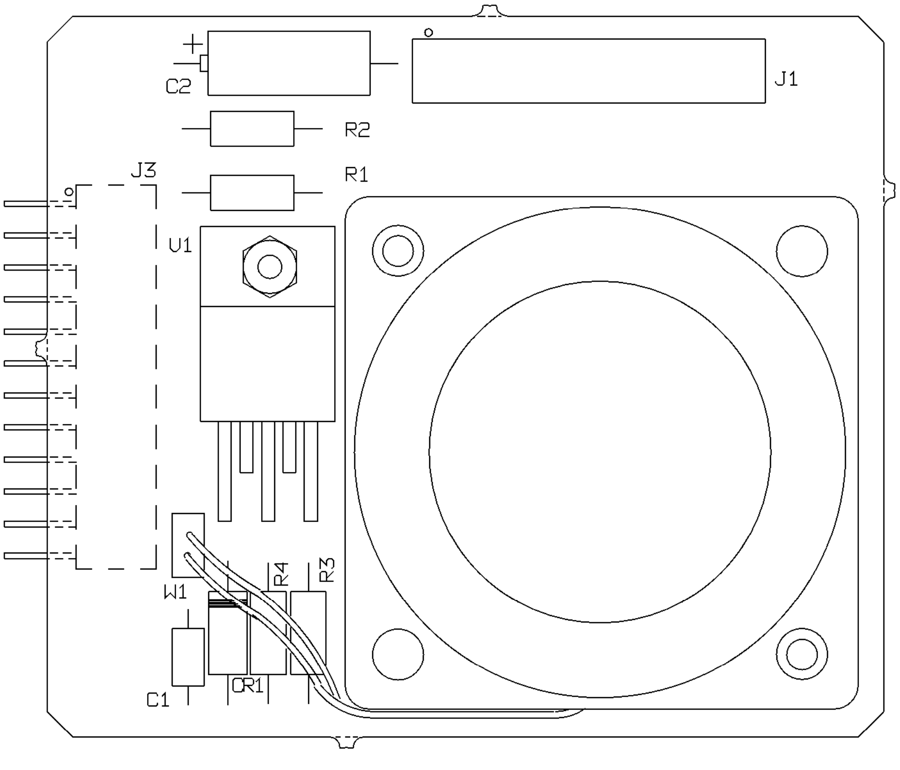
PN 403549

Parts Location Diagram PN 403549-002F 26-2

Parts List PN 403549-002F 26-3

Schematic Diagram PN 403549-003B 26-4

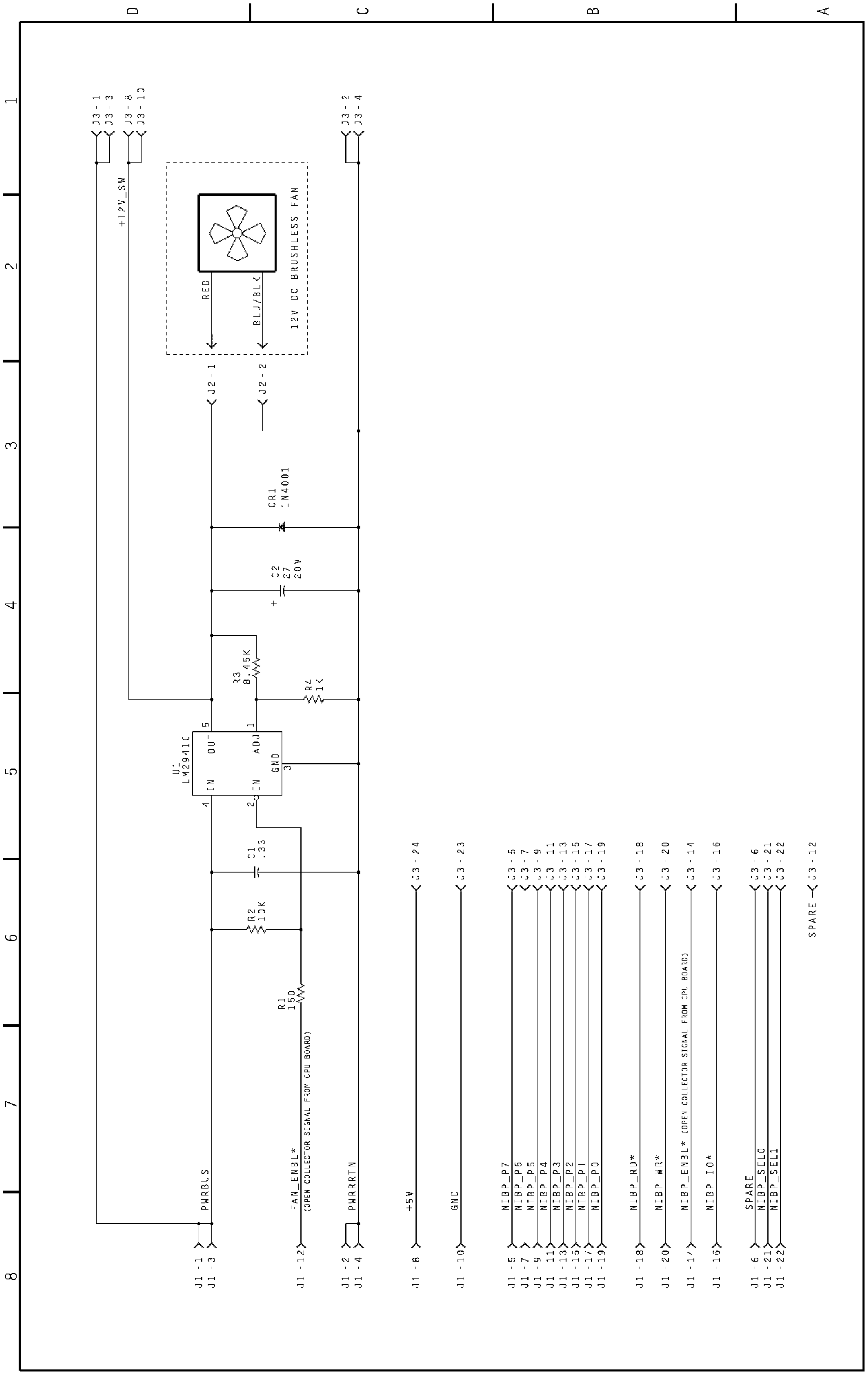
Parts Location Diagram PN 403549-002F


C2
J1
R2
R1
J3
U1
R4
R3
W1
CR1
C1

Parts List PN 403549-002F

Item	Parts List	Part Number	Qty
C1	Cap, Cer, 0.33µF, +80/-20%, 50V	1110-334	1
C2	Cap, Tant, 27µF, 10%, 20V	1135-276	1
CR1	Diode, Rectifier, 2A, 50V 1N4001	2401-001	1
J1	Connector, Receptacle, 22-Pin	404212-001	1
J3	Connector, PC Header, 24-Pin	1848-124	1
R1	Res, MF, 150Ω, 1%, 1/8W	1010-113	1
R2	Res, MF, 10.0K, 1%, 1/8W	1010-287	1
R3	Res, MF, 8.45K, 1%, 1/8W	1010-280	1
R4	Res, MF, 1.0K, 1%, 1/8W	1010-191	1
U1	Volt Rgltr, Adj, TO220 LM2941CT	403609-001	1
-	Fan, 12 V dc, 4.6 CFM	404741-001	1
-	Screw, 8-32 x 3/8	404982-001	2
-	Nut, Hex, Nylon, 4-40	405141-001	1
-	Washer, Nylon, No 5	4550-105	1
-	Screw, PNH, Nylon, 4-40 x 1/4	4779-408	1
-	Circuit Board	403549-001B	1
-	Schematic Diagram	403549-003B	REF

Schematic Diagram PN 403549-003B


D
C
B
A
1
2
3
4
5
6
7
8
J3 - 1
J3 - 3
J3 - 8
J3 - 10
J3 - 2
J3 - 4
+12V_SW
RED
BLU/BLK
12V DC BRUSHLESS FAN
J2 - 1
J2 - 2
CR1
1N4001
C2
27
20V
+
R3
8.45K
R4
1K
U1
LM2941C
OUT
ADJ
IN
EN
GND
5
1
4
2
3
C1
.33
R2
10K
R1
150
PWRBUS
FAN_ENBL*
(OPEN COLLECTOR SIGNAL FROM CPU BOARD)
PWRRTN
+5V
GND
NIBP_P7
NIBP_P6
NIBP_P5
NIBP_P4
NIBP_P3
NIBP_P2
NIBP_P1
NIBP_P0
NIBP_RD*
NIBP_WR*
NIBP_ENBL* (OPEN COLLECTOR SIGNAL FROM CPU BOARD)
NIBP_IO*
SPARE
NIBP_SEL0
NIBP_SEL1
J3 - 24
J3 - 23
J3 - 5
J3 - 7
J3 - 9
J3 - 11
J3 - 13
J3 - 15
J3 - 17
J3 - 19
J3 - 18
J3 - 20
J3 - 14
J3 - 16
J3 - 6
J3 - 21
J3 - 22
SPARE
J3 - 12
J1 - 1
J1 - 3
J1 - 12
J1 - 2
J1 - 4
J1 - 8
J1 - 10
J1 - 5
J1 - 7
J1 - 9
J1 - 11
J1 - 13
J1 - 15
J1 - 17
J1 - 19
J1 - 18
J1 - 20
J1 - 14
J1 - 16
J1 - 6
J1 - 21
J1 - 22

27

MODULE PROCESSOR PCB PN 800210

General **27-2**

Parts Location Diagram PN 800210-005B **27-3**

Parts List PN 800210-005B **27-4**

Schematic Diagram PN SD800210-002B **27-7**

Assembly Revisions PN 800210.. **27-27**

Parts List PN 800210-001E/002B **27-28**

Schematic Diagram PN SD800210-001C **27-31**

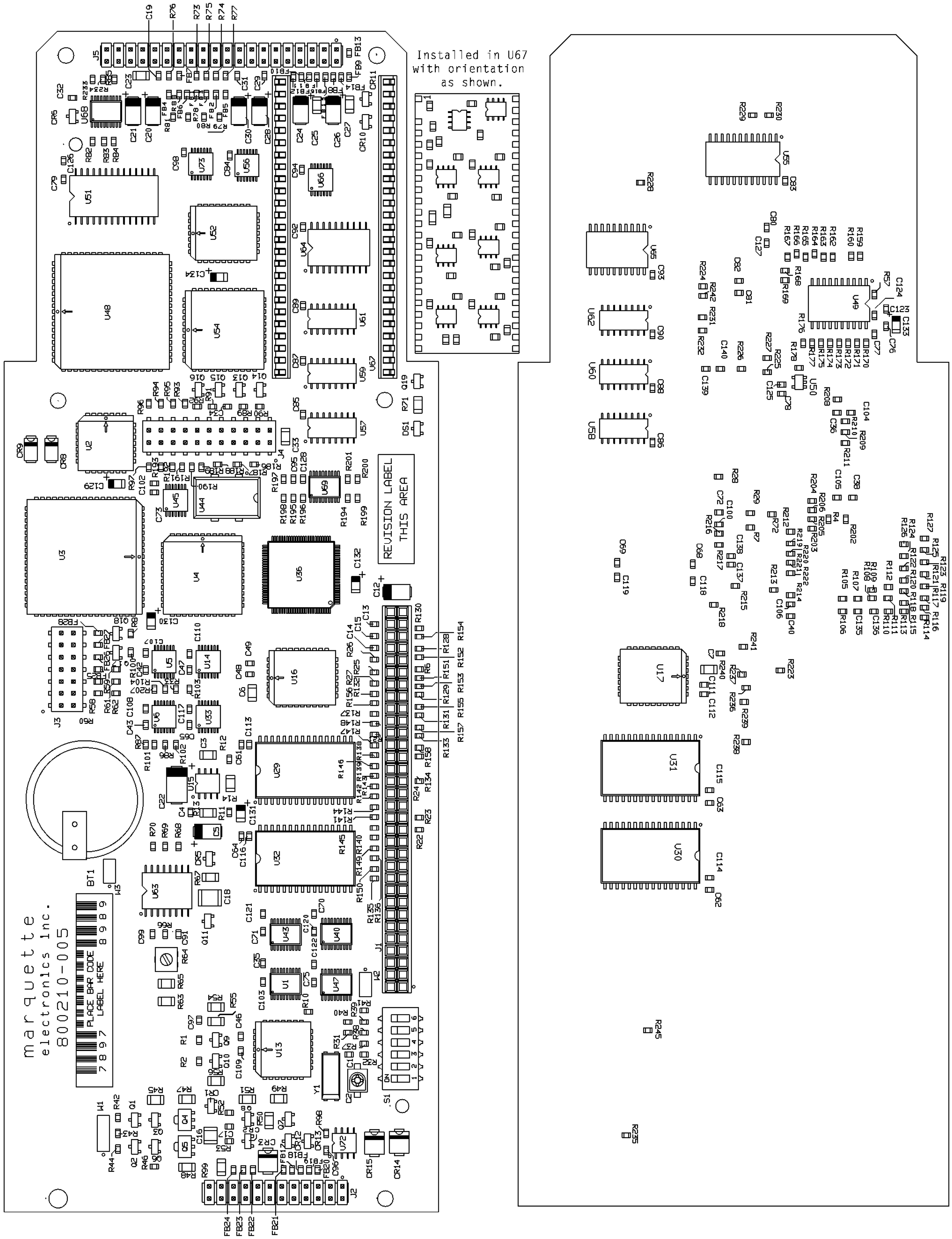
General

There are three different versions of the module processor PCB:

- pn 800210-001, which was used first in all of the A-series modules; and
- pn 800210-002, which was introduced in the SL-series modules, and then added to the A-series modules; and
- pn 800210-005 replaced both of the first two versions.

NOTE
You may replace either version -001 or -002 board with a -005 board, but do not replace a -005 with a -001 or -002 circuit board.

Parts Location Diagram PN 800210-005B


Installed in U67
with orientation
as shown.
REVISION LABEL
THIS AREA
marquette
electronics inc.
800210-005
PLACE BAR CODE
LABEL HERE
J5
J4
J3
J2
J1
BT1
U3
U4
U36
U48
U54
U52
U51
U17
U31
U30
U55
U49
U65
U62
U60
U58

Parts List PN 800210-005B

Item	Parts List	Part Number	Qty
BT1	Battery, Lithium, 3V, Disk	413191-001	1
C1	Cap, NPO, 27pF, 5%, 50V, SM	411576-019	1
C2	Cap, Var, 4 - 25pF, SM	401977-001	1
C3, 6, 7, 23, 25, 27, 33	Cap, Cer, 0.1µF, 20%, 50V	404370-001	7
C4, 97	Cap, Cer, 0.1µF, 5%, 50V, SM	411575-012	2
C5, 24, 26	Cap, Tant, 4.7µF, 20%, 20V, SM	402004-001	3
C12, 20, 21, 28, 30	Cap, Tant, 10µF, 20%, 16V, SM	1176-106	5
C13-15, 17, 19, 29, 31, 32, 34-36, 38, 40, 42, 43, 46-48, 61-65, 68-73, 75-81, 83-96, 98, 99, 112, 136, 137, 140	Cap, Cer, 0.1µF, 5%, 16V	411575-002	56
C16	Cap, Cer, 0.22µF, 20%, 50V, SM	1187-224	1
C18	Cap, Cer, 0.47µF, 20%	1187-474	1
C22	Cap, Tant, 10µF, 20%, 25V, SM	1152-106	1
C49, 82, 100, 102-111, 113-128, 135, 138, 139	Cap, Cer, 1000pF, 5%, 50V, SM	411575-003	32
C129-134	Cap, Tant, 1.0µF, 10%, 16V, SM	406883-002	6
CR1, 6	Diode, Schottky, SM BAT54	401985-001	2
CR2, 10, 11, 12, 13	Diode Pair, Series, SM D7000	2013-201	5
CR3	Diode, Transient Voltage Suppression, SM P6SMB20AT1	403939-001	1
CR5	Diode, SM MMAD4148	401980-001	1
CR8, 9	Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3	403187-001	2
CR14, 15	Diode, Transient Voltage Suppressor, Bi-Directional, 6.8V, 600W	404121-001	1
DS1	Diode, Light-Emitting (Red/Green) LDGR 2340	402428-001	1
FB1-4, 7-16, 21-24, 28	Ferrite Bead BLM11A20	414061-001	19
FB5, 6, 17-20, 25-27	Ferrite Bead BLM11A12	416171-001	9
J1	Connector, PC Header, 64-Pin	1847-064	1
J2	Connector, PC Header, 24-Pin, Vertical	1778-224	1
J3	Connector, PC Header, 14-Pin	416146-001	1
J4	Connector, PC Header, 22-Pin	416146-002	1
J5	Connector, PC Header, 40-Pin	1778-240	1
Q1-3, 6-10, 14, 16, 18, 19	Transistor, NPN, SM T3904	2511-001	12
Q4, 5	Transistor, NPN, SM BCX56-1	2712-056	2
Q11	Transistor, PNP, SM T4403	401978-001	1
Q13, 15, 17	Transistor, PNP, SM T3906	2511-101	3
R1, 2, 28, 57, 69, 70	Res, Cer, 1K, 1%, 1/16W, SM	410334-008	6

Item	Parts List	Part Number	Qty
R4, 72, 143-158, 202	Res, Cer, 100Ω, 1%, 1/16W, SM	410334-003	19
R6, 10-12, 22-24, 26, 27, 31, 32, 37-41, 44, 52, 53, 58, 59, 68, 88, 98, 128-142	Res, Cer, 10K, 1%, 1/16W, SM	410334-013	39
R7, 105-127, 203-206, 208-222, 224-227, 229, 230, 242, 245	Res, Cer, 30.1Ω, 1%, 1/16W, SM	410334-109	1
R8, 46, 90, 92	Res, Cer, 1.50K, 1%, 1/16W, SM	410334-080	4
R13	Res, Cer, 200K, 0.1%, 1/8W, SM	1067-832	1
R14	Res, Cer, 22.9K, 0.1%, 1/8W, SM	1067-833	1
R21, 60-62, 93-97, 186-193	Res, Cer, 150Ω, 1%, 1/16W, SM	410334-028	17
R25, 29, 33, 82, 83-87, 194-201	Res, Cer, 100K, 1%, 1/16W, SM	410334-019	17
R42, 43, 73, 74-77, 89, 91, 100	Res, Cer, 4.75K, 1%, 1/16W, SM	410334-010	10
R45, 49, 54	Res, Cer, 3.4K, 1%, 1/8W, SM	1082-759	3
R47, 48	Res, Cer, 49.9 Ω, 1%, 1/8W, SM	1082-799	2
R50, 55, 56	Res, Cer, 34.8K, 10%, 1/4W, SM	1082-791	3
R51	Res, Cer, 249 Ω, 1%, 1/8W, SM	1082-793	1
R63	Res, Cer, 2.4M, 5%, 1/8W, SM	1081-484	1
R64	Res, Var, 500K, Top Adjust	401979-001	1
R65	Res, Cer, 3.9M, 5%, 1/8W, SM	1081-485	1
R66	Res, Cer, 200Ω, 1%, 1/16W, SM	410334-044	1
R67	Res, Cer, 22M, 5%, 1/8W, SM	1081-486	1
R71, 99	Res, 340 Ω, 1%, 1/8W, SM	1082-790	2
R78-81	Res, Cer, 681Ω, 1%, 1/16W, SM	410334-065	4
R101-104, 159, 160,162-178, 207, 223, 228, 231-241	Res, Cer, 49.9Ω, 1%, 1/16W, SM	410334-040	37
S1	Switch, Dual In-Line, 6-Station, SM	401960-001	1
U1, 43, 47	Buffer/Driver, Octal, SM VHC541	3057-541	3
U2	EPLD, 68000 Interrupt Encoder, PLCC	404570-001	1
U3	Microprocessor, 16-MHz, PLCC 68HC000	401968-001	1
U4	EPLD, 68000 Bus Control, PLCC	408137-004	1
U5, 66	Inverter, Hex, SM VHC04	3057-004	2
U6, 14, 33, 56	OR Gate, 2-Input, Quad , SM VHC32	3057-032	5
U13	Clock/Timer, SM DP8570	401970-001	1
U15	Volt Rgltr, Adj, SM LP2951A	3076-001	1
U16, 17	EEPROM, Flash, 2K x 8-Bit, 90nS, PLCC	408792-002	2
U29, 30, 31, 32	RAM, Static, 128K x 8-Bit, 70nS, SM 628128	406255-002	4
U36	RAM, CMOS, Dual Port, 64K x 8-Bit, SM TQFP	415860-001	1
U40, 69	Transceiver, Bus, Octal, SM VHC245	3057-245	2
U44	Oscillator, CMOS, 14.7456MHz, SM	401480-001	1

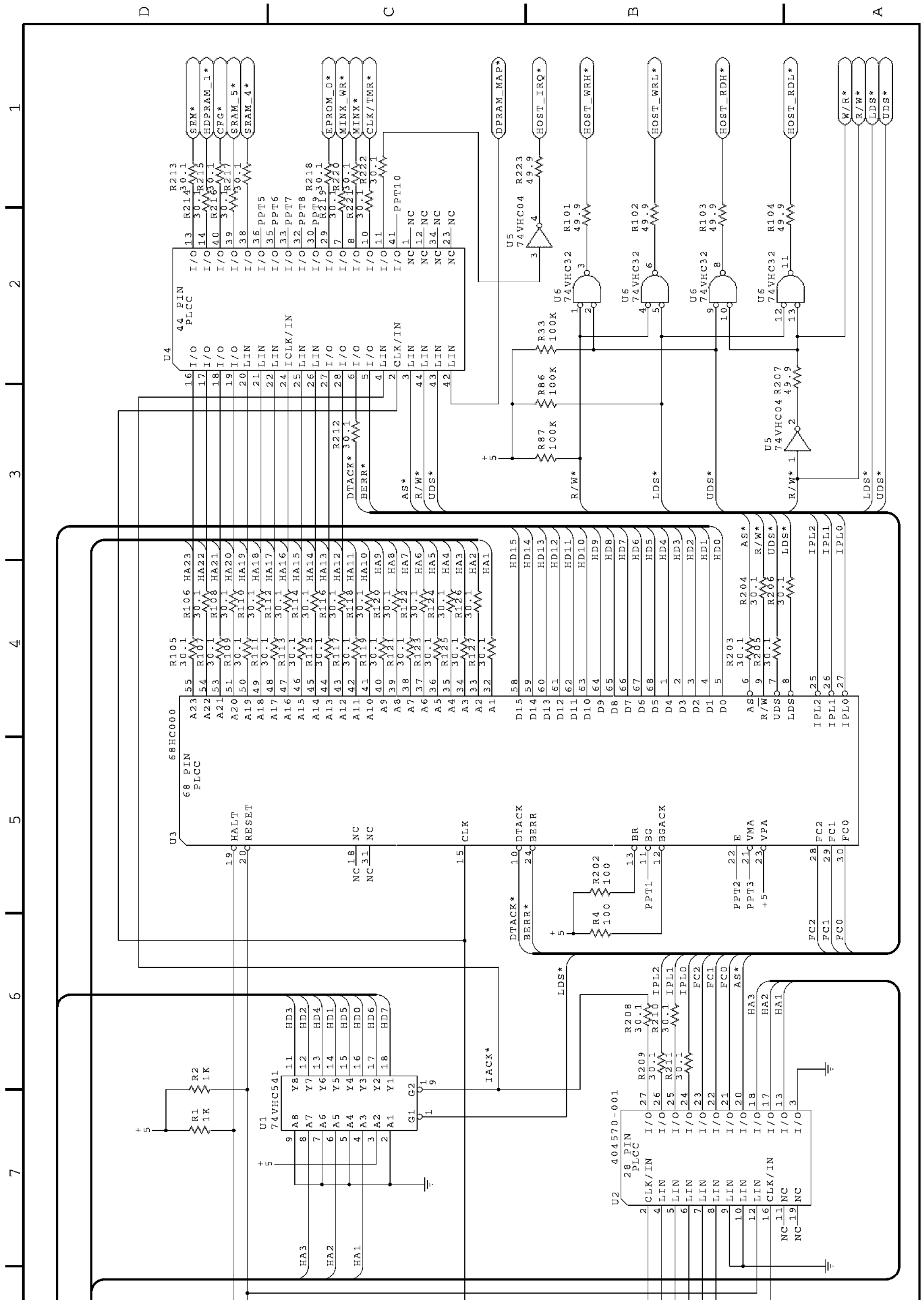
Item	Parts List	Part Number	Qty
U45	Flip-Flop, Type D, Dual, SM VHC74	3057-074	1
U48	PAL, Programmed, Communication Control, PLCC 80C152JB	400368-001	1
U49	Latch, Transparent, Three-State Output, Octal, SM HC573	401971-001	1
U50	EPROM, Programmed, Boot Code, PLCC	409035-001	1
U51	RAM, Static, 32K x 8-Bit , SM 62256FLP	3202-256	1
U52	EPROM, Programmed, 80C152 Boot Code, PLCC	404904-002	1
U54	EPLD, Communication Interface, PLCC	408139-001	1
U55	Decoder/Demultiplexer, 4-Line-to-16-Line, SM HC154	404210-001	1
U57, 58	Shift Register, 8-Bit, Serial Input, Serial/Parallel Output, Tri-State Output, SM HC595	401969-001	2
U59, 60, 61, 62	Shift Register, Parallel Load, 8-Bit, SM HC165	401972-001	4
U63	Microprocessor Support Circuit, SM MAX695	401966-001	1
U64, 65	Register, 8-Bit, SM HC273	3038-273	2
U67	Hybrid, Analog Output	401205-001	1
U68	Buffer, Three-State Output, Octal, SM VHC244	3057-244	1
U72	Line Driver/Receiver, Differential, SM DS8921AM	404013-001	1
W1-1, W1-2, W1-3, W2-1, W2-2, W3-1, W3-2	Socket, Mini	1818-201	7
Y1	Crystal, 32.768kHz, SM	402085-001	1
-	Jumper, Mini	1859-201	2
-	Lubricant, Anti-Fretting (For U67)	410286-001	1
-	Mounting Pad, Battery (For BT1)	404368-001	1
-	Insulator, Battery (For BT1)	415683-001	1
-	Socket, Hybrid (For U67)	404596-001	2
-	Circuit Board	800211-002A	1
-	Schematic Diagram	SD800210-002B	-

Schematic Diagram

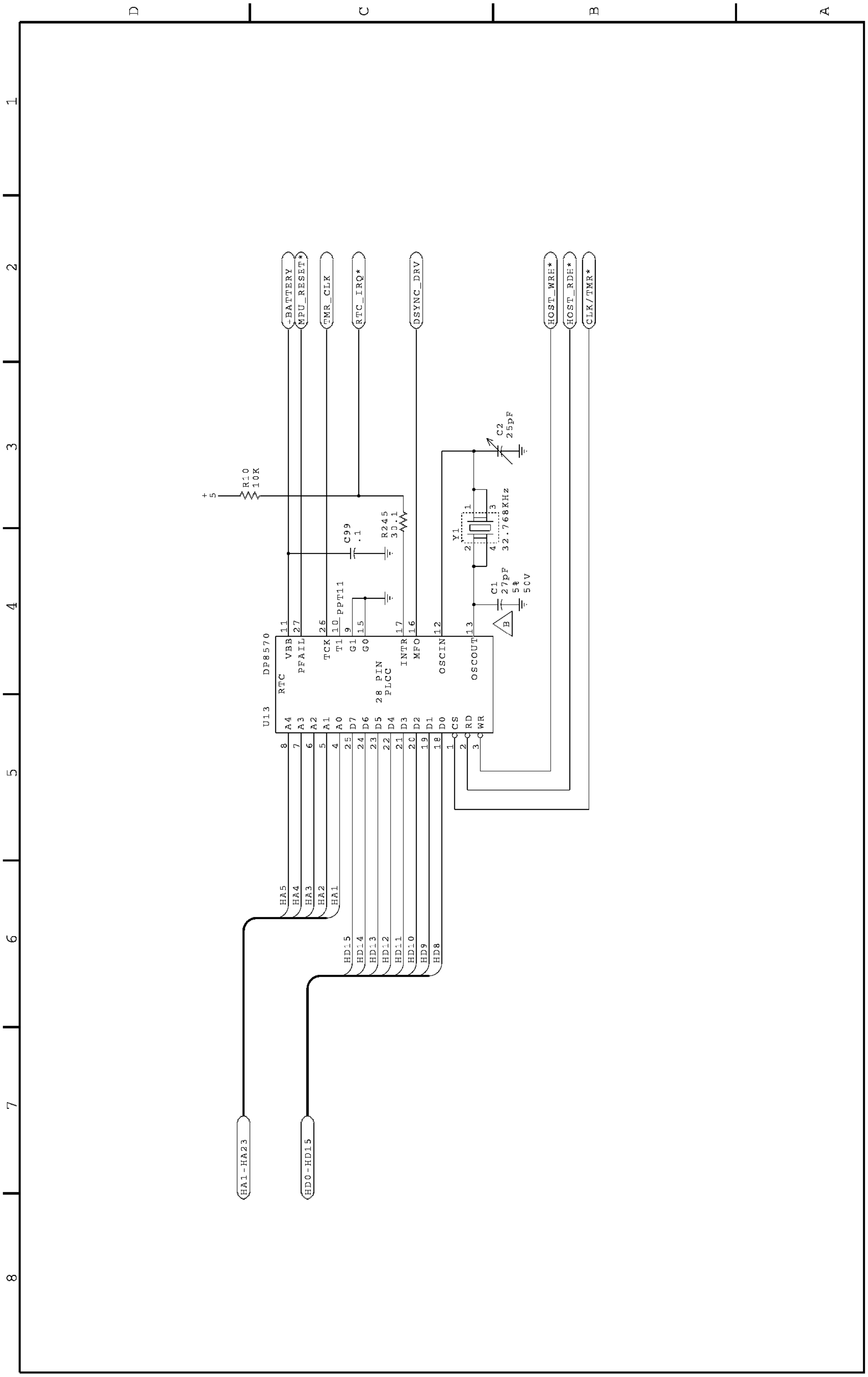
PN SD800210-002B

1 of 20

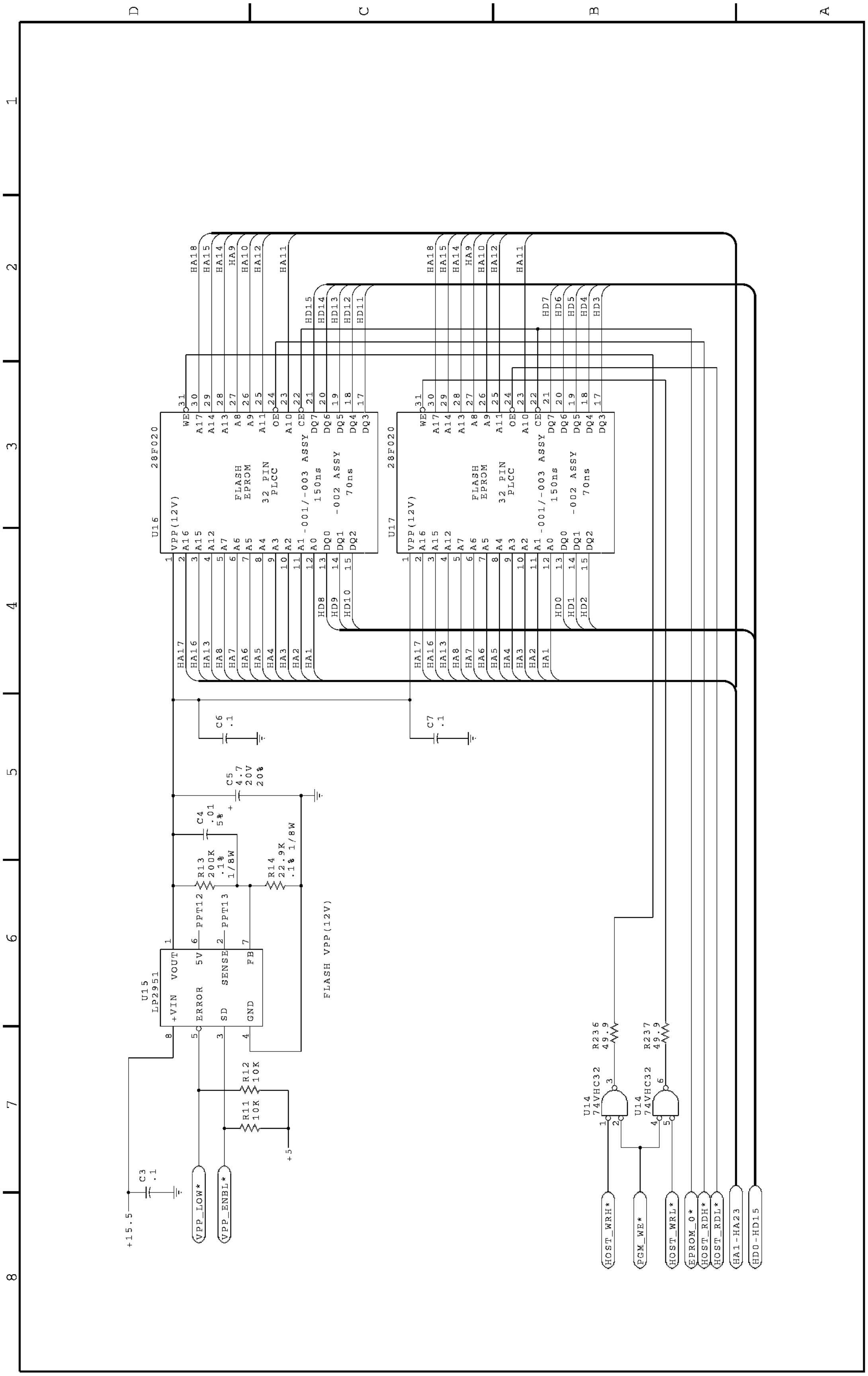
NOTE: For PN 800210-005 PCB


D
C
B
A
1
2
3
4
5
6
7
8
SEM*
HDPRAM_1*
CFG*
SRAM_5*
SRAM_4*
EPROM_0*
MINX_WR*
MINX*
CLK/TMR*
DPRAM_MAP*
HOST_IRQ*
HOST_WRH*
HOST_WRL*
HOST_RDH*
HOST_RDL*
W/R*
R/W*
LDS*
UDS*
U4
44 PIN
PLCC
U5
74VHC04
U6
74VHC32
U3
68HC000
68 PIN
PLCC
U1
74VHC541
U2
404570-001
28 PIN
PLCC
DTACK*
BERR*
AS*
IACK*
HD0-HD15
HA1-HA23
MPU_HALT*
MPU_RESET*
MPU_CLK
MARKER_IN
MINX_IRQ*
PULSE_IRQ*
SCC_IRQ*
RTC_IRQ*

2 of 20

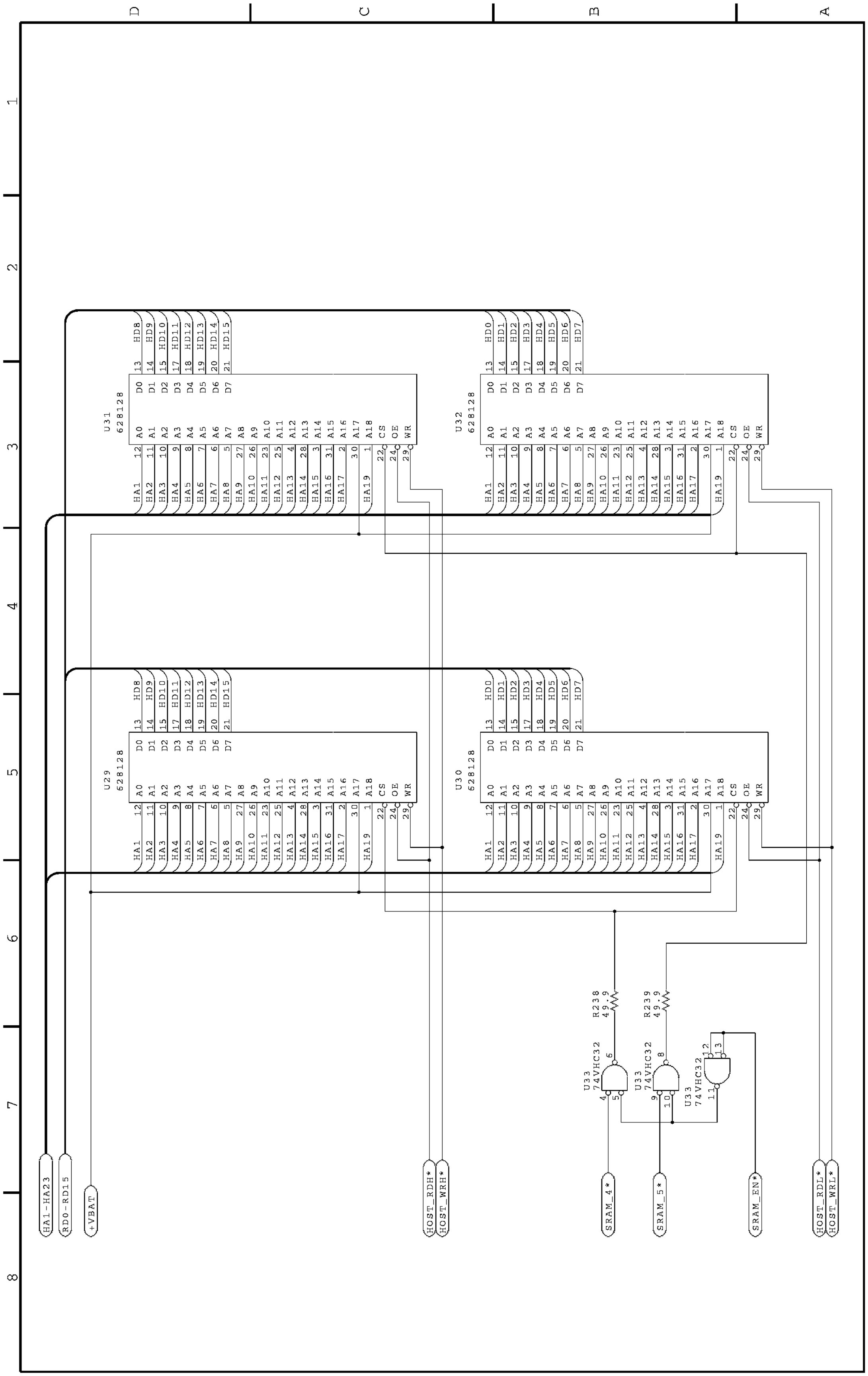

D
C
B
A
1
2
3
4
5
6
7
8
-BATTERY
MPU_RESET*
TMR_CLK
RTC_IRQ*
DSYNC_DRV
HOST_WRE*
HOST_RDE*
CLK/TMR*
C2
25pF
R10
10K
+5
R245
30.1
C99
.1
Y1
1
2
3
4
32.768KHz
C1
27pF
5%
50V
PPT11
B
U13
DP8570
RTC
28 PIN
PLCC
VBB 11
PFAIL 27
TCK 26
T1 10
G1 9
G0 15
INTR 17
MFO 16
OSCIN 12
OSCOUT 13
A4 8
A3 7
A2 6
A1 5
A0 4
D7 25
D6 24
D5 23
D4 22
D3 21
D2 20
D1 19
D0 18
CS 1
RD 2
WR 3
HA5
HA4
HA3
HA2
HA1
HD15
HD14
HD13
HD12
HD11
HD10
HD9
HD8
HA1-HA23
HD0-HD15

3 of 20

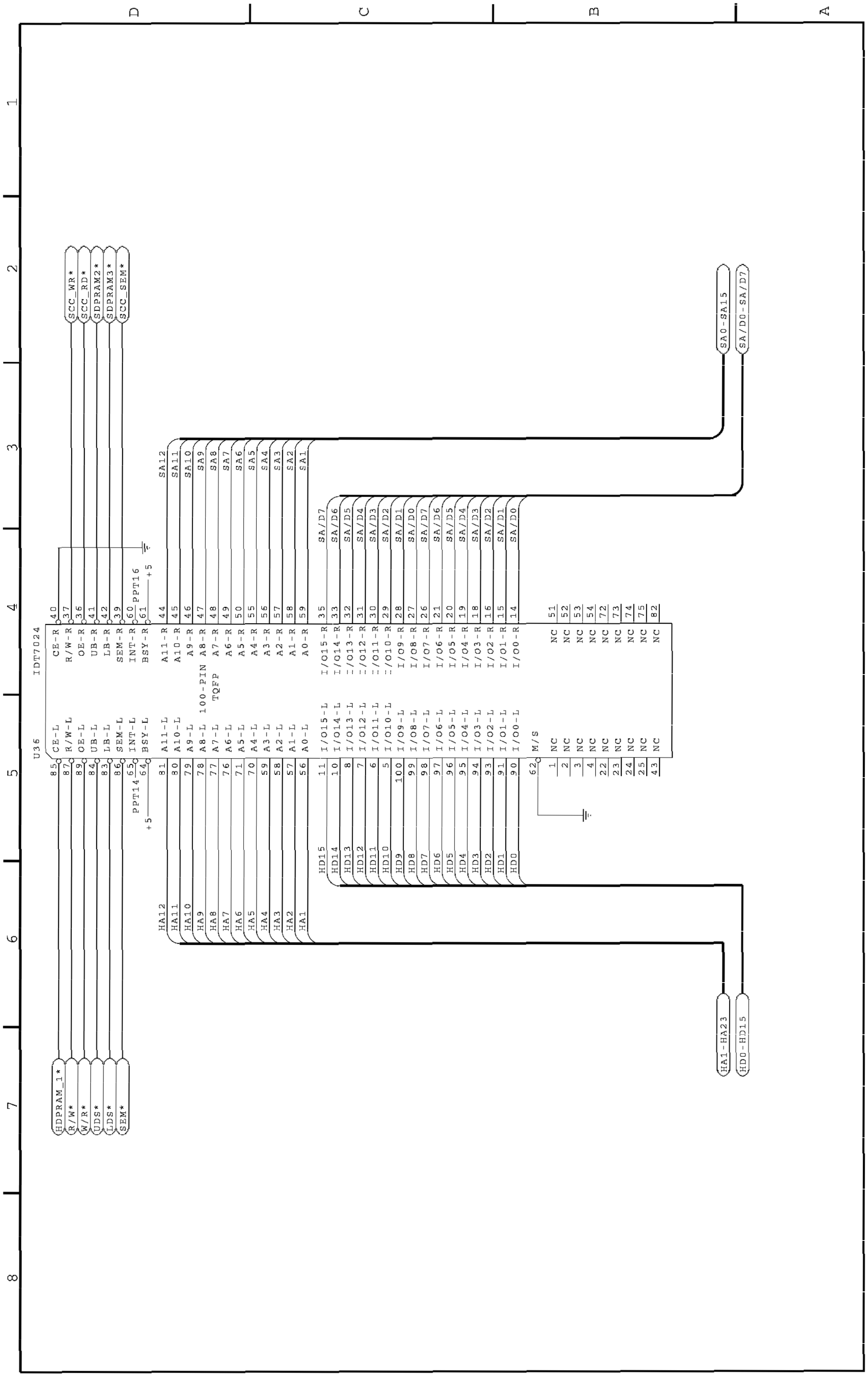


D
C
B
A
1
2
3
4
5
6
7
8
U16
28F020
VPP(12V)
FLASH
EPROM
32 PIN
PLCC
-001/-003 ASSY
150ns
-002 ASSY
70ns
U17
28F020
WE
CE
OE
HA18
HA15
HA14
HA9
HA10
HA12
HA11
HD15
HD14
HD13
HD12
HD11
HD7
HD6
HD5
HD4
HD3
HA17
HA16
HA13
HA8
HA7
HA6
HA5
HA4
HA3
HA2
HA1
HD8
HD9
HD10
HD0
HD1
HD2
C6
.1
C7
.1
C5
4.7
20V
20%
C4
.01
5%
R13
200K
.1%
1/8W
R14
22.9K
.1% 1/8W
PPT12
PPT13
U15
LP2951
+VIN
VOUT
ERROR
5V
SD
SENSE
GND
FB
FLASH VPP(12V)
R12
10K
R11
10K
+5
C3
.1
+15.5
VPP_LOW*
VPP_ENBL*
U14
74VHC32
R236
49.9
R237
49.9
HOST_WRH*
PGM_WE*
HOST_WRL*
EPROM_0*
HOST_RDH*
HOST_RDL*
HA1-HA23
HD0-HD15

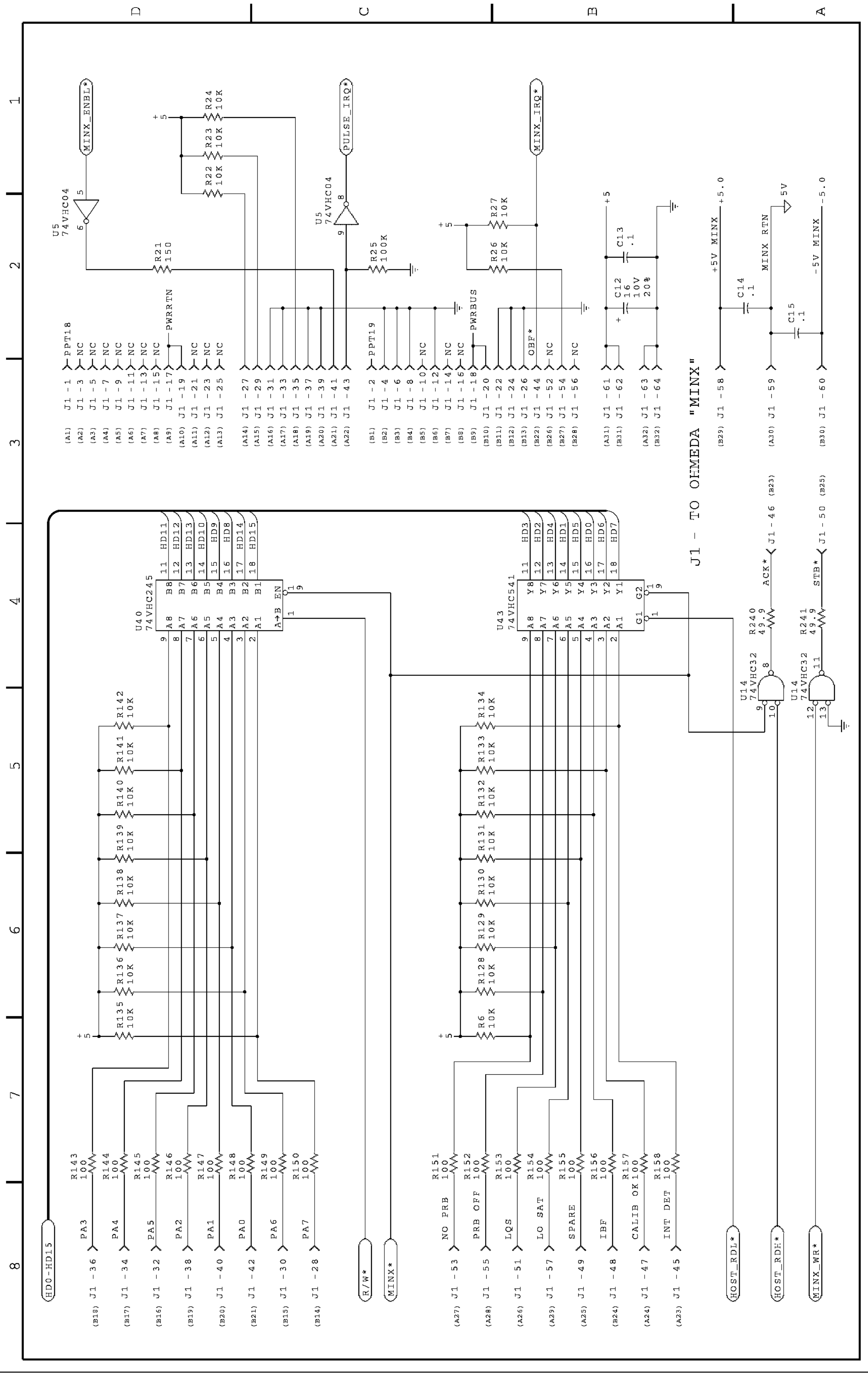
4 of 20


D
C
B
A
1
2
3
4
5
6
7
8
U31
628128
U32
628128
U29
628128
U30
628128
D0
D1
D2
D3
D4
D5
D6
D7
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
CS
OE
WR
HD0
HD1
HD2
HD3
HD4
HD5
HD6
HD7
HD8
HD9
HD10
HD11
HD12
HD13
HD14
HD15
HA1
HA2
HA3
HA4
HA5
HA6
HA7
HA8
HA9
HA10
HA11
HA12
HA13
HA14
HA15
HA16
HA17
HA19
U33
74VHC32
R238
49.9
R239
49.9
HA1-HA23
RD0-RD15
+VBAT
HOST_RDH*
HOST_WRH*
SRAM_4*
SRAM_5*
SRAM_EN*
HOST_RDL*
HOST_WRL*

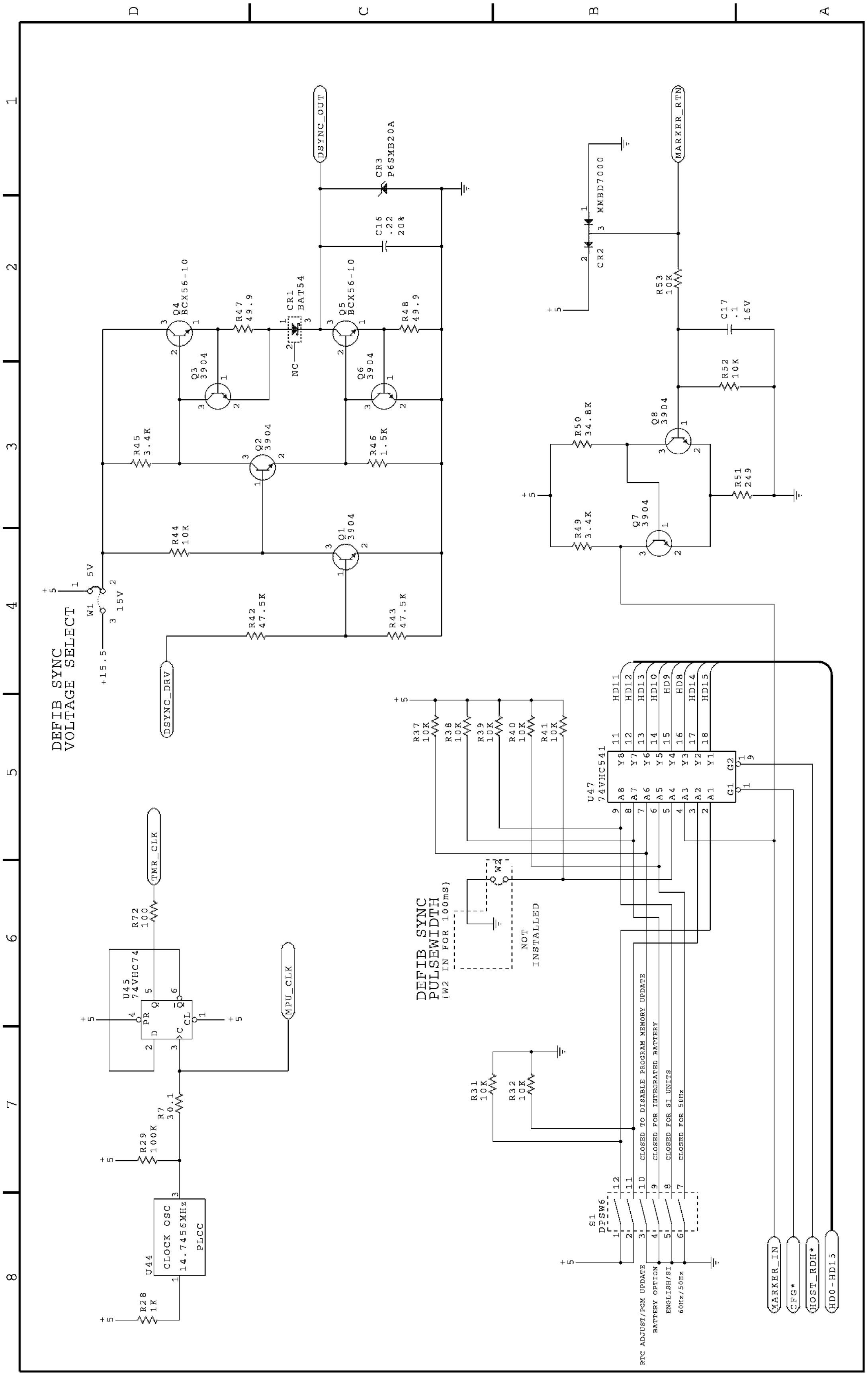
5 of 20


U36
IDT7024
100-PIN TQFP
CE-L 85 / CE-R 40
R/W-L 87 / R/W-R 37
OE-L 89 / OE-R 36
UB-L 84 / UB-R 41
LB-L 83 / LB-R 42
SEM-L 86 / SEM-R 39
INT-L 65 / INT-R 60
BSY-L 64 / BSY-R 61
PPT14
PPT16
+5
A11-L 81 / A11-R 44
A10-L 80 / A10-R 45
A9-L 79 / A9-R 46
A8-L 78 / A8-R 47
A7-L 77 / A7-R 48
A6-L 76 / A6-R 49
A5-L 71 / A5-R 50
A4-L 70 / A4-R 55
A3-L 59 / A3-R 56
A2-L 58 / A2-R 57
A1-L 57 / A1-R 58
A0-L 56 / A0-R 59
I/O15-L 11 / I/O15-R 35
I/O14-L 10 / I/O14-R 33
I/O13-L 8 / I/O13-R 32
I/O12-L 7 / I/O12-R 31
I/O11-L 6 / I/O11-R 30
I/O10-L 5 / I/O10-R 29
I/O9-L 100 / I/O9-R 28
I/O8-L 99 / I/O8-R 27
I/O7-L 98 / I/O7-R 26
I/O6-L 97 / I/O6-R 21
I/O5-L 96 / I/O5-R 20
I/O4-L 95 / I/O4-R 19
I/O3-L 94 / I/O3-R 18
I/O2-L 93 / I/O2-R 16
I/O1-L 91 / I/O1-R 15
I/O0-L 90 / I/O0-R 14
M/S 62
NC 1, 2, 3, 4, 22, 23, 24, 25, 43
NC 51, 52, 53, 54, 72, 73, 74, 75, 82
SCC_WR*
SCC_RD*
SDPRAM2*
SDPRAM3*
SCC_SEM*
HDPRAM_1*
R/W*
W/R*
UDS*
LDS*
SEM*
SA12 SA11 SA10 SA9 SA8 SA7 SA6 SA5 SA4 SA3 SA2 SA1
SA/D7 SA/D6 SA/D5 SA/D4 SA/D3 SA/D2 SA/D1 SA/D0 SA/D7 SA/D6 SA/D5 SA/D4 SA/D3 SA/D2 SA/D1 SA/D0
HA12 HA11 HA10 HA9 HA8 HA7 HA6 HA5 HA4 HA3 HA2 HA1
HD15 HD14 HD13 HD12 HD11 HD10 HD9 HD8 HD7 HD6 HD5 HD4 HD3 HD2 HD1 HD0
SA0-SA15
SA/D0-SA/D7
HA1-HA23
HD0-HD15
D
C
B
A
1
2
3
4
5
6
7
8

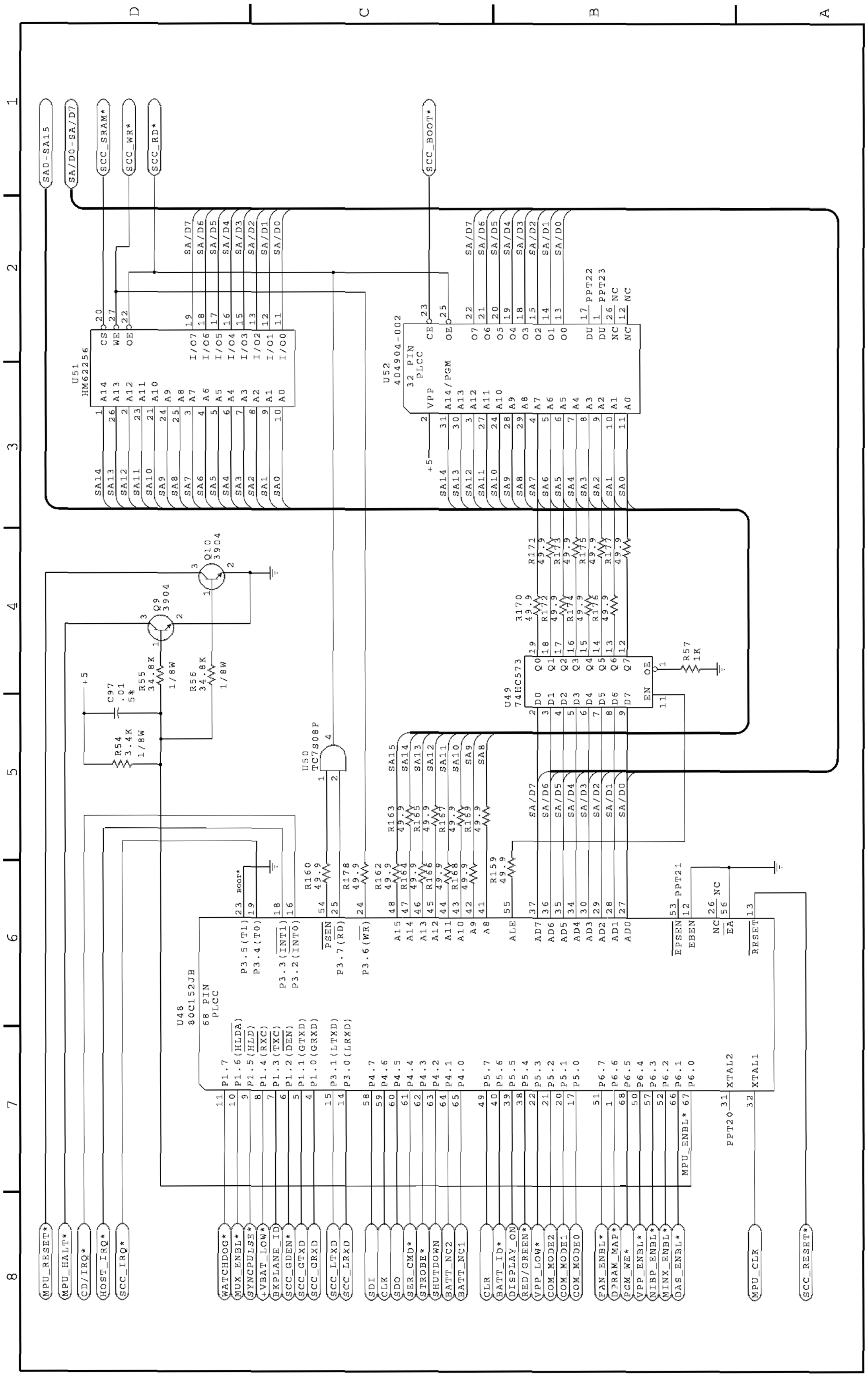
6 of 20


J1 - TO OHMEDA "MINX"
MINX_ENBL*
PULSE_IRQ*
MINX_IRQ*
U5 74VHC04
R21 150
R22 10K
R23 10K
R24 10K
R25 100K
R26 10K
R27 10K
C12 16 10V 20%
C13 .1
C14 .1
C15 .1
PPT18
PPT19
PWRRTN
PWRBUS
OBF*
NC
+5V MINX
+5.0
MINX RTN
5V
-5V MINX
-5.0
U40 74VHC245
U43 74VHC541
U14 74VHC32
R240 49.9
R241 49.9
ACK*
STB*
HD0-HD15
R/W*
MINX*
HOST_RDL*
HOST_RDH*
MINX_WR*
PA3
PA4
PA5
PA2
PA1
PA0
PA6
PA7
NO PRB
PRB OFF
LQS
LO SAT
SPARE
IBF
CALIB OK
INT DET
A
B
C
D
1
2
3
4
5
6
7
8

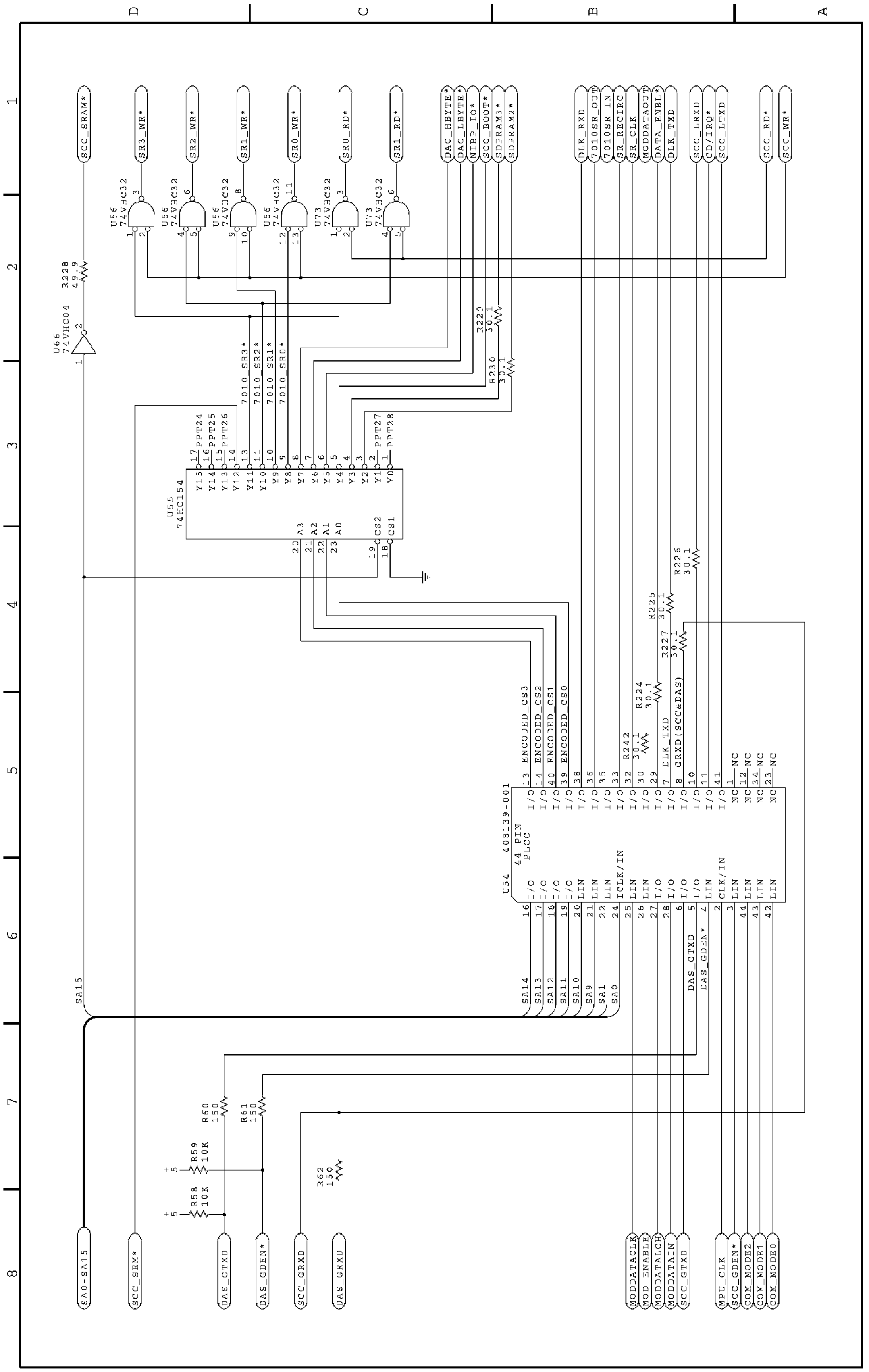
7 of 20


D
C
B
A
1
2
3
4
5
6
7
8
DEFIB SYNC VOLTAGE SELECT
W1
+5
1 5V
2
3 15V
+15.5
DSYNC_DRV
DSYNC_OUT
CR3 P6SMB20A
C16 .22 20%
Q4 BCX56-10
R47 49.9
CR1 BAT54
NC
Q5 BCX56-10
R48 49.9
Q3 3904
Q6 3904
R45 3.4K
Q2 3904
R46 1.5K
R44 10K
Q1 3904
R42 47.5K
R43 47.5K
MARKER_RTN
CR2 MMBD7000
+5
R53 10K
C17 .1 16V
R52 10K
R50 34.8K
Q8 3904
R51 249
R49 3.4K
Q7 3904
R37 10K
R38 10K
R39 10K
R40 10K
R41 10K
U47 74VHC541
HD11
HD12
HD13
HD10
HD9
HD8
HD14
HD15
DEFIB SYNC PULSEWIDTH (W2 IN FOR 100mS)
W2
NOT INSTALLED
TMR_CLK
R72 100
U45 74VHC74
PR
Q
D
C
CL
MPU_CLK
R7 30.1
R29 100K
U44 CLOCK OSC 14.7456MHz PLCC
R28 1K
R31 10K
R32 10K
S1 DPSW6
CLOSED TO DISABLE PROGRAM MEMORY UPDATE
CLOSED FOR INTEGRATED BATTERY
CLOSED FOR SI UNITS
CLOSED FOR 50Hz
RTC ADJUST/PGM UPDATE
BATTERY OPTION
ENGLISH/SI
60Hz/50Hz
MARKER_IN
CFG*
HOST_RDH*
HD0-HD15

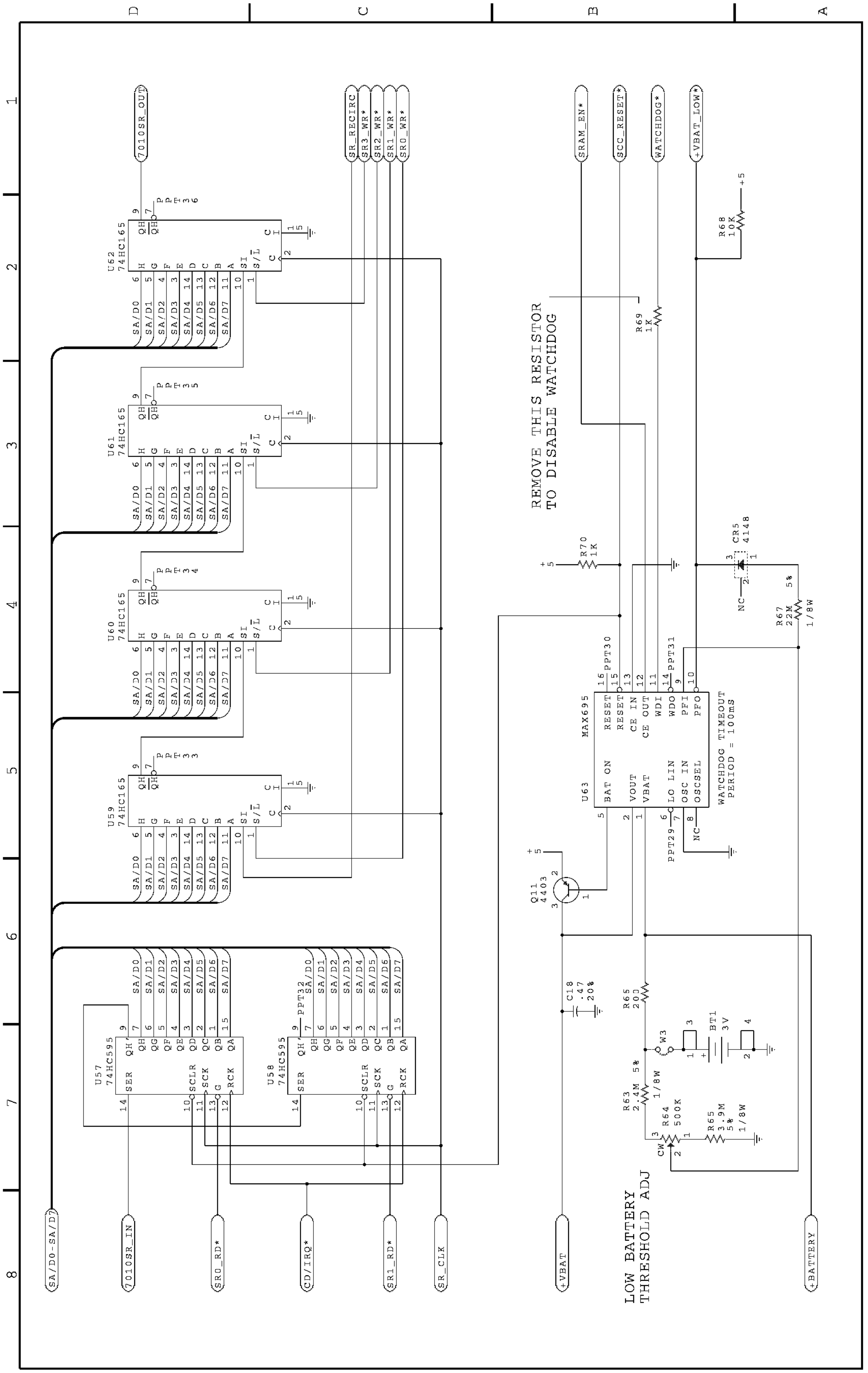
8 of 20


U51
HM62256
U52
404904-002
32 PIN
PLCC
U49
74HC573
U50
TC7S08F
U48
80C152JB
68 PIN
PLCC
Q9
3904
Q10
3904
R54
3.4K
1/8W
R55
34.8K
1/8W
R56
34.8K
1/8W
C97
.01
5%
R57
1K
SA0-SA15
SA/D0-SA/D7
SCC_SRAM*
SCC_WR*
SCC_RD*
SCC_BOOT*
MPU_RESET*
MPU_HALT*
CD/IRQ*
HOST_IRQ*
SCC_IRQ*
WATCHDOG*
MUX_ENBL*
SYNCPULSE*
+VBAT_LOW*
BKPLANE_ID
SCC_GDEN*
SCC_GTXD
SCC_GRXD
SCC_LTXD
SCC_LRXD
SDI
CLK
SDO
SER_CMD*
STROBE*
SHUTDOWN
BATT_NC2
BATT_NC1
CLR
BATT_ID*
DISPLAY_ON
RED/GREEN*
VPP_LOW*
COM_MODE2
COM_MODE1
COM_MODE0
FAN_ENBL*
DPRAM_MAP*
PGM_WE*
VPP_ENBL*
NIBP_ENBL*
MINX_ENBL*
DAS_ENBL*
MPU_CLK
SCC_RESET*
MPU_ENBL*
PPT20
PPT21
PPT22
PPT23
XTAL1
XTAL2
RESET
EPSEN
EBEN
ALE
PSEN
D
C
B
A
1
2
3
4
5
6
7
8

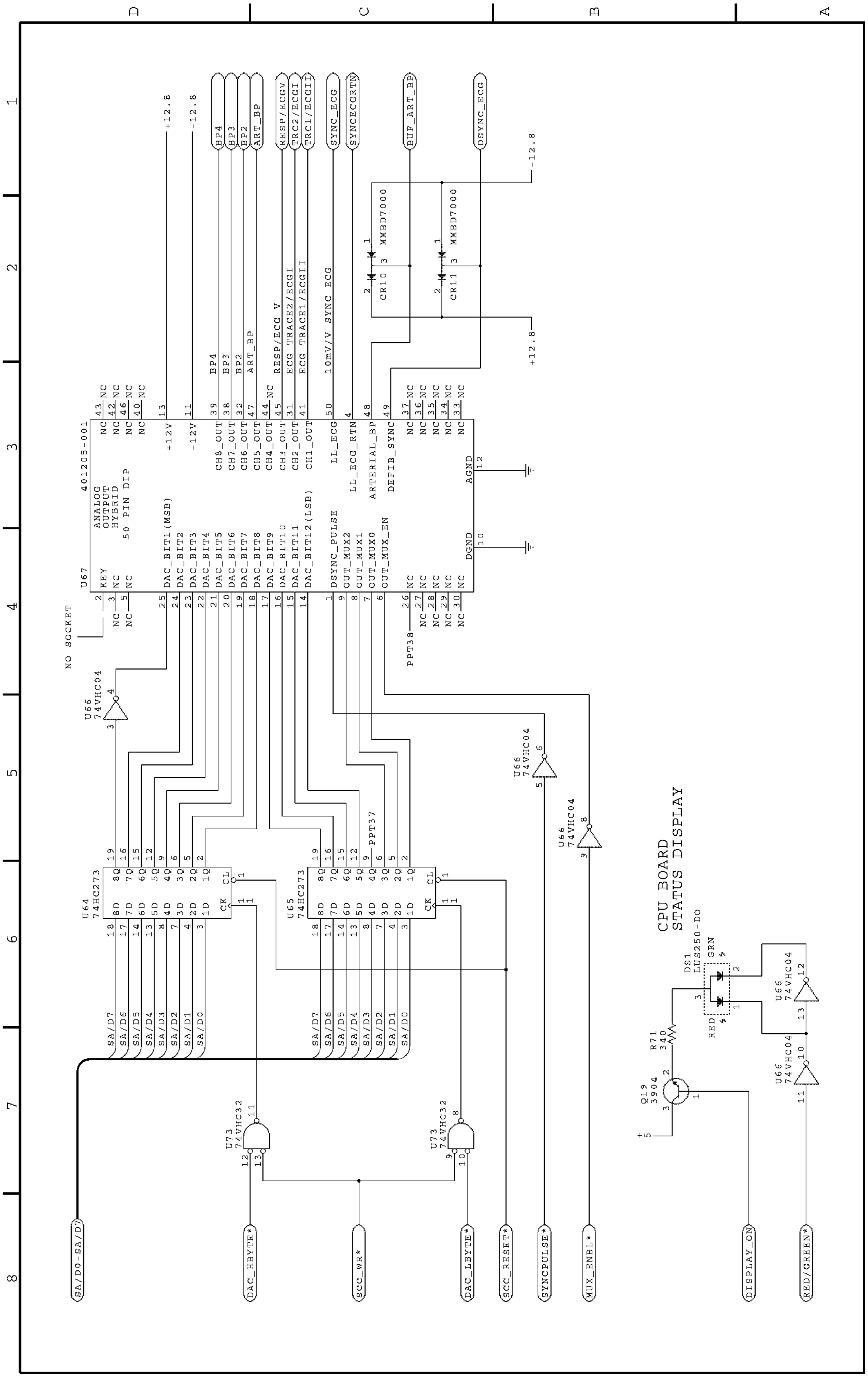
9 of 20


SCC_SRAM*
SR3_WR*
SR2_WR*
SR1_WR*
SR0_WR*
SR0_RD*
SR1_RD*
DAC_HBYTE*
DAC_LBYTE*
NIBP_IO*
SCC_BOOT*
SDPRAM3*
SDPRAM2*
DLK_RXD
7010SR_OUT
7010SR_IN
SR_RECIRC
SR_CLK
MODDATAOUT
DATA_ENBL*
DLK_TXD
SCC_LRXD
CD/IRQ*
SCC_LTXD
SCC_RD*
SCC_WR*
U56 74VHC32
U73 74VHC32
U66 74VHC04
R228 49.9
R229 30.1
R230 30.1
7010_SR3*
7010_SR2*
7010_SR1*
7010_SR0*
PPT24
PPT25
PPT26
PPT27
PPT28
U55 74HC154
CS2
CS1
A3 A2 A1 A0
ENCODED_CS3
ENCODED_CS2
ENCODED_CS1
ENCODED_CS0
R226 30.1
R225 30.1
R227 30.1
R224 30.1
R242 30.1
DLK_TXD
GRXD(SCC&DAS)
U54 408139-001 44 PIN PLCC
SA15
SA14 SA13 SA12 SA11 SA10 SA9 SA1 SA0
DAS_GTXD
DAS_GDEN*
R60 150
R61 150
R62 150
R59 10K
R58 10K
+5
SA0-SA15
SCC_SEM*
DAS_GTXD
DAS_GDEN*
SCC_GRXD
DAS_GRXD
MODDATACLK
MOD_ENABLE
MODDATALCH
MODDATAIN
SCC_GTXD
MPU_CLK
SCC_GDEN*
COM_MODE2
COM_MODE1
COM_MODE0
A B C D
1 2 3 4 5 6 7 8

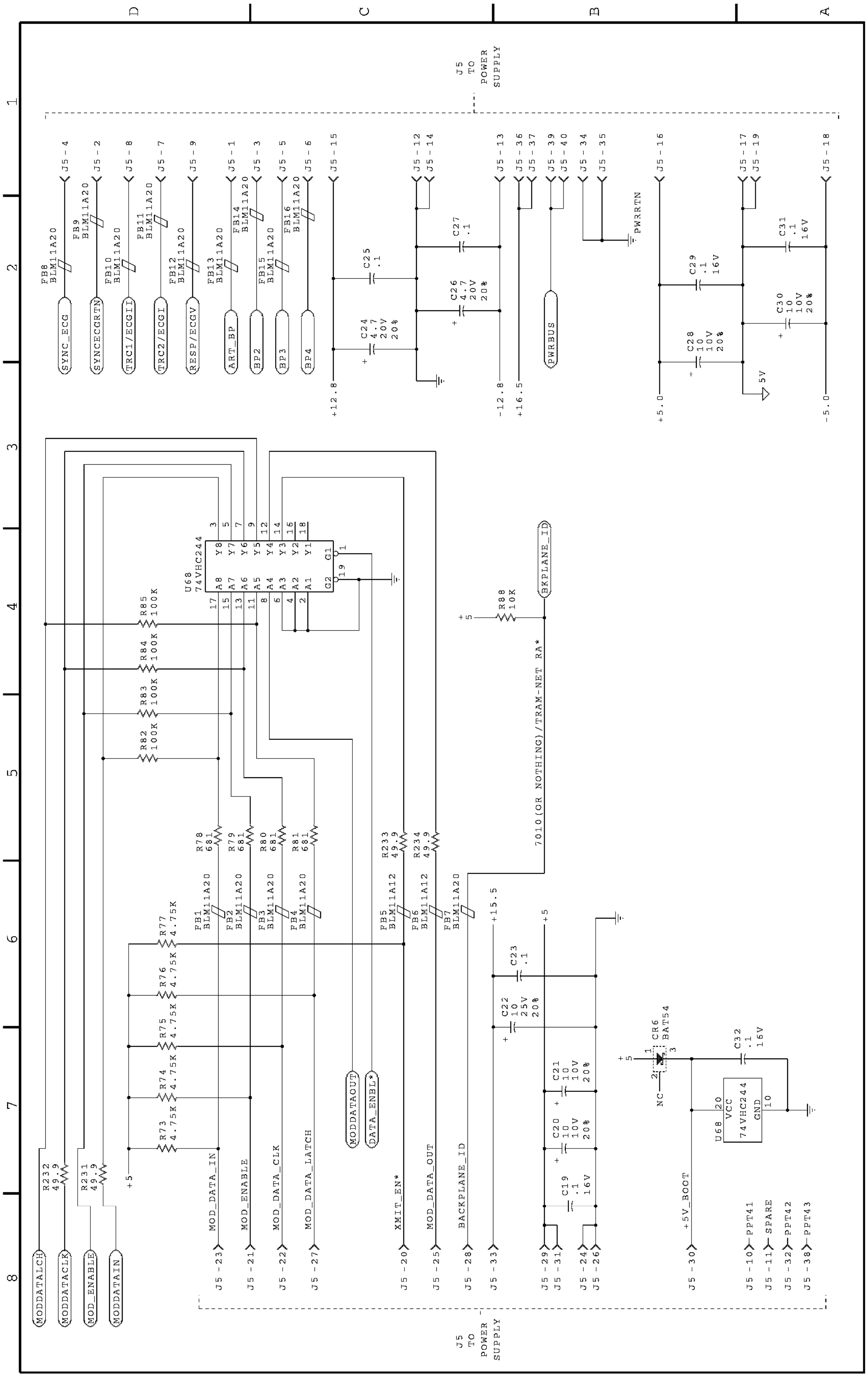
10 of 20


7010SR_OUT
SR_RECIRC
SR3_WR*
SR2_WR*
SR1_WR*
SR0_WR*
SRAM_EN*
SCC_RESET*
WATCHDOG*
+VBAT_LOW*
U62 74HC165
U61 74HC165
U60 74HC165
U59 74HC165
PPT36
PPT35
PPT34
PPT33
SA/D0
SA/D1
SA/D2
SA/D3
SA/D4
SA/D5
SA/D6
SA/D7
QH
SI
S/L
CI
C
R68 10K
+5
R69 1K
REMOVE THIS RESISTOR
TO DISABLE WATCHDOG
R70 1K
CR5 4148
NC
R67 22M 5% 1/8W
PPT30
PPT31
MAX695
U63
RESET
CE IN
CE OUT
WDI
WDO
PFI
PFO
BAT ON
VOUT
VBAT
LO LIN
OSC IN
OSCSEL
WATCHDOG TIMEOUT
PERIOD = 100mS
PPT29
Q11 4403
U57 74HC595
U58 74HC595
PPT32
SER
SCLR
SCK
G
RCK
QA
QB
QC
QD
QE
QF
QG
QH'
C18 .47 20%
R65 20Ω
W3
BT1 3V
R63 2.4M 5% 1/8W
R64 500K
CW
R65 3.9M 5% 1/8W
LOW BATTERY
THRESHOLD ADJ
SA/D0-SA/D7
7010SR_IN
SR0_RD*
CD/IRQ*
SR1_RD*
SR_CLK
+VBAT
+BATTERY
A
B
C
D
1
2
3
4
5
6
7
8

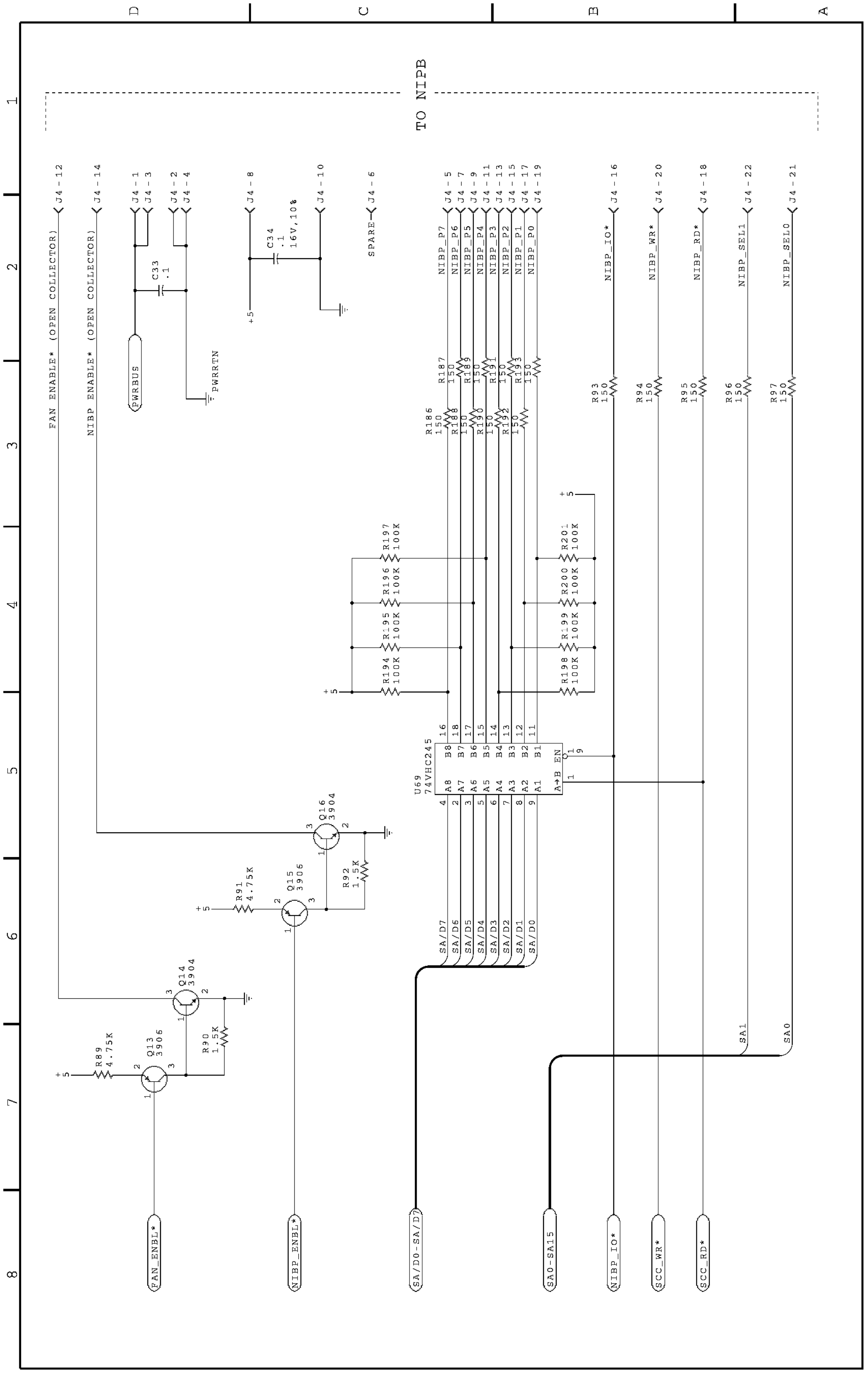
11 of 20


D
C
B
A
1
2
3
4
5
6
7
8
U67
401205-001
ANALOG OUTPUT HYBRID
50 PIN DIP
KEY
NO SOCKET
DAC_BIT1(MSB)
DAC_BIT2
DAC_BIT3
DAC_BIT4
DAC_BIT5
DAC_BIT6
DAC_BIT7
DAC_BIT8
DAC_BIT9
DAC_BIT10
DAC_BIT11
DAC_BIT12(LSB)
DSYNC_PULSE
OUT_MUX2
OUT_MUX1
OUT_MUX0
OUT_MUX_EN
DGND
AGND
+12V
-12V
CH8_OUT
CH7_OUT
CH6_OUT
CH5_OUT
CH4_OUT
CH3_OUT
CH2_OUT
CH1_OUT
LL_ECG
LL_ECG_RTN
ARTERIAL_BP
DEFIB_SYNC
NC
+12.8
-12.8
BP4
BP3
BP2
ART_BP
RESP/ECGV
TRC2/ECGI
TRC1/ECGII
SYNC_ECG
SYNCECGRTN
BUF_ART_BP
DSYNC_ECG
RESP/ECG V
ECG TRACE2/ECGI
ECG TRACE1/ECGII
10mV/V SYNC ECG
CR10
CR11
MMBD7000
PPT38
PPT37
U66
74VHC04
U64
74HC273
U65
74HC273
CK
CL
SA/D7
SA/D6
SA/D5
SA/D4
SA/D3
SA/D2
SA/D1
SA/D0
U73
74VHC32
SA/D0-SA/D7
DAC_HBYTE*
SCC_WR*
DAC_LBYTE*
SCC_RESET*
SYNCPULSE*
MUX_ENBL*
DISPLAY_ON
RED/GREEN*
CPU BOARD
STATUS DISPLAY
DS1
LUS250-DO
GRN
RED
R71
340
Q19
3904
+5

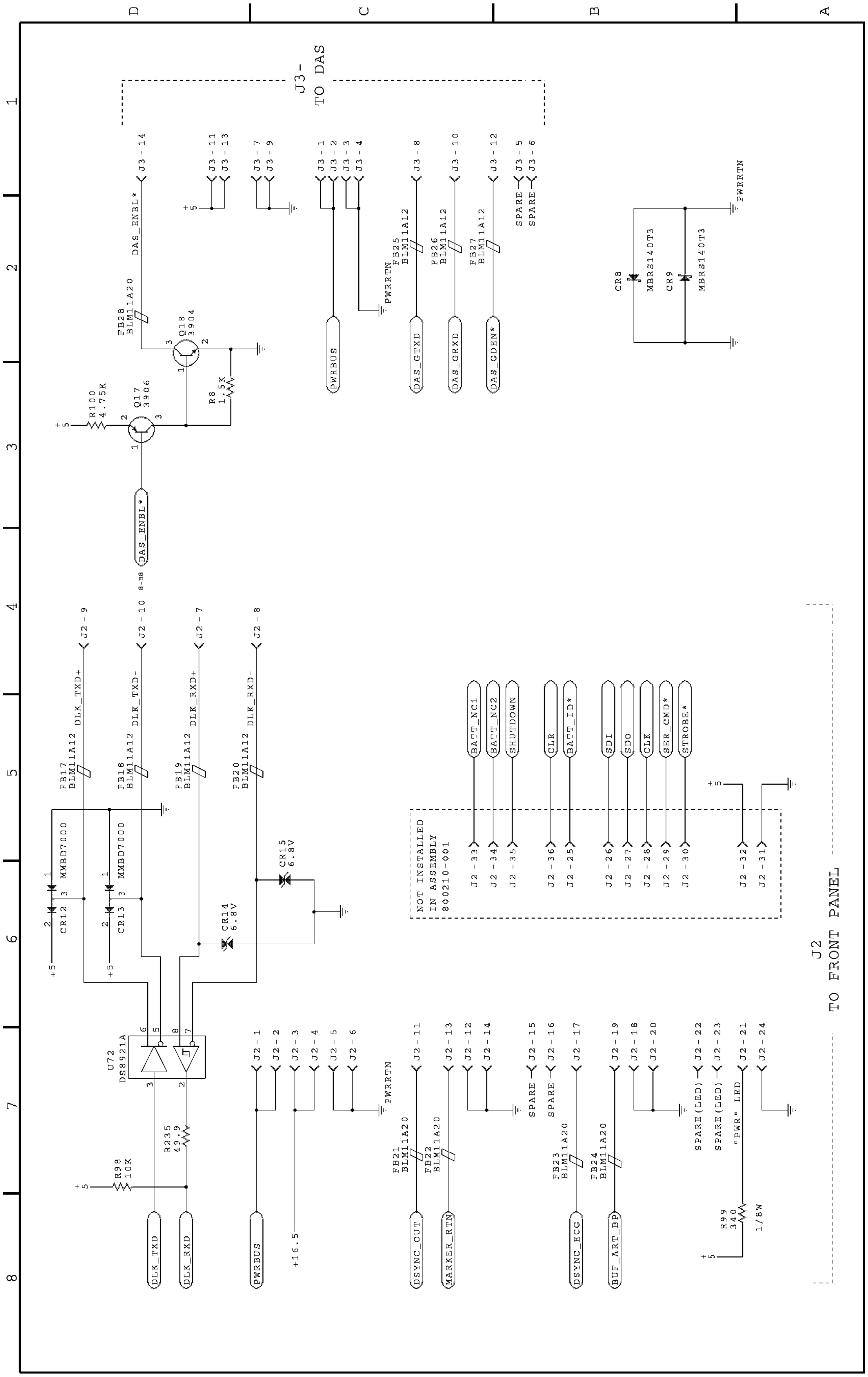
12 of 20


D
C
B
A
1
2
3
4
5
6
7
8
J5 TO POWER SUPPLY
J5 - 4
J5 - 2
J5 - 8
J5 - 7
J5 - 9
J5 - 1
J5 - 3
J5 - 5
J5 - 6
J5 - 15
J5 - 12
J5 - 14
J5 - 13
J5 - 36
J5 - 37
J5 - 39
J5 - 40
J5 - 34
J5 - 35
J5 - 16
J5 - 17
J5 - 19
J5 - 18
FB8 BLM11A20
FB9 BLM11A20
FB10 BLM11A20
FB11 BLM11A20
FB12 BLM11A20
FB13 BLM11A20
FB14 BLM11A20
FB15 BLM11A20
FB16 BLM11A20
SYNC_ECG
SYNCECGRTN
TRC1/ECGII
TRC2/ECGI
RESP/ECGV
ART_BP
BP2
BP3
BP4
+12.8
C24 4.7 20V 20%
C25 .1
C26 4.7 20V 20%
C27 .1
-12.8
+16.5
PWRBUS
PWRRTN
+5.0
C28 10 10V 20%
C29 .1 16V
C30 10 10V 20%
C31 .1 16V
5V
-5.0
U68 74VHC244
A8 A7 A6 A5 A4 A3 A2 A1
Y8 Y7 Y6 Y5 Y4 Y3 Y2 Y1
G1 G2
17 15 13 11 8 6 4 2
3 5 7 9 12 14 16 18
1 19
R85 100K
R84 100K
R83 100K
R82 100K
+5
R88 10K
BKPLANE_ID
7010(OR NOTHING)/TRAM-NET RA*
R78 681
R79 681
R80 681
R81 681
R233 49.9
R234 49.9
FB1 BLM11A20
FB2 BLM11A20
FB3 BLM11A20
FB4 BLM11A20
FB5 BLM11A12
FB6 BLM11A12
FB7 BLM11A20
R77 4.75K
R76 4.75K
R75 4.75K
R74 4.75K
R73 4.75K
+5
+15.5
+5
C23 .1
C22 10 25V 20%
C21 10 10V 20%
C20 10 10V 20%
C19 .1 16V
CR6 BAT54
NC
C32 .1 16V
U68 74VHC244 VCC GND 20 10
+5V_BOOT
MODDATAOUT
DATA_ENBL*
R232 49.9
R231 49.9
MODDATALCH
MODDATACLK
MOD_ENABLE
MODDATAIN
MOD_DATA_IN
MOD_ENABLE
MOD_DATA_CLK
MOD_DATA_LATCH
XMIT_EN*
MOD_DATA_OUT
BACKPLANE_ID
J5 - 23
J5 - 21
J5 - 22
J5 - 27
J5 - 20
J5 - 25
J5 - 28
J5 - 33
J5 - 29
J5 - 31
J5 - 24
J5 - 26
J5 - 30
J5 - 10 PPT41
J5 - 11 SPARE
J5 - 32 PPT42
J5 - 38 PPT43
J5 TO POWER SUPPLY

13 of 20

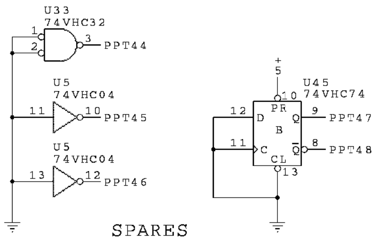

TO NIPB
FAN ENABLE* (OPEN COLLECTOR)
NIBP ENABLE* (OPEN COLLECTOR)
J4-12
J4-14
J4-1
J4-3
J4-2
J4-4
J4-8
J4-10
J4-6
J4-5
J4-7
J4-9
J4-11
J4-13
J4-15
J4-17
J4-19
J4-16
J4-20
J4-18
J4-22
J4-21
C33 .1
C34 .1 16V,10%
PWRBUS
PWRRTN
+5
SPARE
NIBP_P7
NIBP_P6
NIBP_P5
NIBP_P4
NIBP_P3
NIBP_P2
NIBP_P1
NIBP_P0
NIBP_IO*
NIBP_WR*
NIBP_RD*
NIBP_SEL1
NIBP_SEL0
R186 150
R187 150
R188 150
R189 150
R190 150
R191 150
R192 150
R193 150
R93 150
R94 150
R95 150
R96 150
R97 150
R194 100K
R195 100K
R196 100K
R197 100K
R198 100K
R199 100K
R200 100K
R201 100K
U69 74VHC245
A8 A7 A6 A5 A4 A3 A2 A1
B8 B7 B6 B5 B4 B3 B2 B1
A→B
EN
Q16 3904
Q15 3906
Q14 3904
Q13 3906
R91 4.75K
R92 1.5K
R89 4.75K
R90 1.5K
SA/D7
SA/D6
SA/D5
SA/D4
SA/D3
SA/D2
SA/D1
SA/D0
SA1
SA0
FAN_ENBL*
NIBP_ENBL*
SA/D0-SA/D7
SA0-SA15
NIBP_IO*
SCC_WR*
SCC_RD*
D C B A
1 2 3 4 5 6 7 8

14 of 20


J3-
TO DAS
J2
TO FRONT PANEL
DAS_ENBL*
FB28 BLM11A20
Q18 3904
Q17 3906
R100 4.75K
R8 1.5K
PWRBUS
DAS_GTXD
DAS_GRXD
DAS_GDEN*
FB25 BLM11A12
FB26 BLM11A12
FB27 BLM11A12
PWRRTN
SPARE
CR8 MBRS140T3
CR9 MBRS140T3
DLK_TXD+
DLK_TXD-
DLK_RXD+
DLK_RXD-
FB17 BLM11A12
FB18 BLM11A12
FB19 BLM11A12
FB20 BLM11A12
CR12 MMBD7000
CR13 MMBD7000
CR14 6.8V
CR15 6.8V
U72 DS8921A
R235 49.9
R98 10K
DLK_TXD
DLK_RXD
+16.5
BATT_NC1
BATT_NC2
SHUTDOWN
CLR
BATT_ID*
SDI
SDO
CLK
SER_CMD*
STROBE*
NOT INSTALLED IN ASSEMBLY 800210-001
DSYNC_OUT
MARKER_RTN
DSYNC_ECG
BUF_ART_BP
FB21 BLM11A20
FB22 BLM11A20
FB23 BLM11A20
FB24 BLM11A20
SPARE (LED)
"PWR" LED
R99 340 1/8W
A
B
C
D
1
2
3
4
5
6
7
8

IC POWER/RETURN CHART						POWER SUPPLY							
IC		POWER		RETURN		BYPASS							
U1	74VHC541	20	+5	10		C35	.1	C103	.001 *				
U2	5AC312	1,28	+5	14,15		C36	.1	C104	.001 *				
U3	68HC000	14&52	+5	16,17,56,57		C38	.1	C105	.001 *	C135	.1	C136	.001 *	C129	1.0 16V
U4	5AC324	15,37	+5	9,31		C40	.1	C106	.001 *	C137	.1	C138	.001 *	C130	1.0 16V
U5	74VHC04	14	+5	7		C42	.1	C107	.001 *				
U6	74VHC32	14	+5	7		C43	.1	C108	.001 *				
U13	DP8570	28	+5	14		C46	.1	C109	.001 *				
U14	74VHC32	14	+5	7		C47	.1	C110	.001 *				
U16	28F020 -150nS	32	+5	16	GND	C48	.1	C111	.001 *				
U17	28F020 -150nS	32	+5	16	GND	C49	.1	C112	.001 *				
U29	628128L -120nS	32	+VBAT	16	GND	C61	.1	C113	.001 *	C131	1.0 16V		
U30	628128L -120nS	32	+VBAT	16	GND	C62	.1	C114	.001 *				
U31	628128L -120nS	32	+VBAT	16	GND	C63	.1	C115	.001 *				
U32	628128L -120nS	32	+VBAT	16	GND	C64	.1	C116	.001 *				
U33	74VHC32	14	+VBAT	7		C65	.1	C117	.001 *				
U36	7024LA	12,17,88	+5	9,13,34 38,63,92		C68	.1	C118	.001 *	C132	1.0 16V		
						C69	.1	C119	.001 *				
U40	74VHC245	20	+5	10		C70	.1	C120	.001 *				
U43	74VHC541	20	+5	10		C71	.1	C121	.001 *				
U44	CLK OSC 14.7456MHz	4	+5	2	GND	C72	.1	C100	.001 *				
U45	74VHC74	14	+5	7		C73	.1	C102	.001 *				
U47	74VHC541	20	+5	10		C75	.1	C122	.001 *				
U48	80C152JB -1	2	+5	3,33	GND	C76	.1	C123	.001 *	C133	1.0 16V		
U49	74HC573	20	+5	10		C77	.1	C124	.001 *				
U50	TC7S08F	5	+5	3		C78	.1	C125	.001 *				
U51	HM62256 -120 OR -150	28	+5	14	GND	C79	.1	C126	.001 *				
U52	27C256 -150nS	32	+5	16	GND	C80	.1	C127	.001 *				
U54	5AC324	15,37	+5	9,31		C81	.1	C82	.001 *	C139	.1	C140	.001 *	C134	1.0 16V
U55	74HC154	24	+5	12		C83	.1						
U56	74VHC32	14	+5	7		C84	.1						
U57	74HC595	16	+5	8		C85	.1						
U58	74HC595	16	+5	8		C86	.1						
U59	74HC165	16	+5	8		C87	.1						
U60	74HC165	16	+5	8		C88	.1						
U61	74HC165	16	+5	8		C89	.1						
U62	74HC165	16	+5	8		C90	.1						
U63	MAX695	3	+5	4		C91	.1						
U64	74HC273	20	+5	10		C92	.1						
U65	74HC273	20	+5	10		C93	.1						
U66	74VHC04	14	+5	7		C94	.1						
U69	74VHC245	20	+5	10		C95	.1	C128	.001*				
U72	DS8921A	1	+5	4		C96	.1						
U73	74VHC32	14	+5	7		C98	.1						

*=5%,50V



SPARES

16 of 20

LABEL	PAGE COORDINATES
+12.8:	11-B3,D1 12-C3
+15.5:	3-D8 7-D4 12-C6
+16.5:	12-B3 14-C8
+5.0:	6-B2 12-B3
+BATTERY:	2-C2 10-A8
+VBAT:	4-D8 10-B8
+VBAT_LOW*:	8-C8 10-B1
-12.8:	11-B1,D1 12-B3
-5.0:	6-A2 12-A3
7010SR_IN:	9-B1 10-D8
7010SR_OUT:	9-B1 10-D1
ART_BP:	11-C1 12-D3
AS*:	1-B3,B6,C3
BATT_ID*:	8-B8 14-B5
BATT_NC1:	8-C8 14-C5
BATT_NC2:	8-C8 14-C5
BERR*:	1-C3,C6
BKPLANE_ID:	8-C8 12-B4
BP2:	11-D1 12-C3
BP3:	11-D1 12-C3
BP4:	11-D1 12-C3
BUF_ART_BP:	11-C1 14-B8
CD/IRQ*:	8-D8 9-B1 10-C8
CFG*:	1-D1 7-A8

LABEL	PAGE COORDINATES
CLK:	8-C8 14-B5
CLK/TMR*:	1-C1 2-B2
CLR:	8-C8 14-B5
COM_MODE0:	8-B8 9-A8
COM_MODE1:	8-B8 9-A8
COM_MODE2:	8-B8 9-A8
DAC_HBYTE*:	9-C1 11-D8
DAC_LBYTE*:	9-C1 11-C8
DAS_ENBL*:	8-B8 14-D4
DAS_GDEN*:	9-C8 14-C3
DAS_GRXD:	9-C8 14-C3
DAS_GTXD:	9-D8 14-C3
DATA_ENBL*:	9-B1 12-C7
DISPLAY_ON:	8-B8 11-A8
DLK_RXD:	9-B1 14-D8
DLK_TXD:	9-B1 14-D8
DPRAM_MAP*:	1-C1 8-B8
DSYNC_DRV:	2-C2 7-D5
DSYNC_ECG:	11-C1 14-B8
DSYNC_OUT:	7-C1 14-C8
DTACK*:	1-C3,C6
EPROM_0*:	1-C1 3-B8
FAN_ENBL*:	8-B8 13-D8
FC0:	1-A6,B6
FC1:	1-A6,B6
FC2:	1-A6,B6

LABEL	PAGE COORDINATES
HA1:	1-B6,C4,C7 2-C6 3-B4,C4 4-C3,C5,D3,D5 5-C6
HA2:	1-B6,C4,C7 2-C6 3-B4,C4 4-B3,B5,D3,D5 5-C6
HA3:	1-B6,C4,C7 2-C6 3-B4,C4 4-B3,B5,D3,D5 5-C6
HA4:	1-C4 2-C6 3-B4,C4 4-B3,B5,D3,D5 5-C6
HA5:	1-C4 2-C6 3-C4 4-B3,B5,D3,D5 5-D6
HA6:	1-C4 3-C4,D4 4-B3,B5,D3,D5 5-D6
HA7:	1-C4 3-C4,D4 4-B3,B5,D3,D5 5-D6
HA8:	1-C4 3-C4,D4 4-B3,B5,D3,D5 5-D6
HA9:	1-C4 3-C2,D2 4-B3,B5,D3,D5 5-D6
HA10:	1-C4 3-C2,D2 4-B3,B5,D3,D5 5-D6
HA11:	1-C4 3-B2,C2 4-B3,B5,C3,C5 5-D6
HA12:	1-C4 3-C2 4-B3,B5,C3,C5 5-D6

LABEL	PAGE COORDINATES
HA13:	1-C4 3-C4,D4 4-B3,B5,C3,C5
HA14:	1-C4 3-C2,D2 4-B3,B5,C3,C5
HA15:	1-C4 3-C2,D2 4-B3,B5,C3,C5
HA16:	1-C4 3-C4,D4 4-B3,B5,C3,C5
HA17:	1-D4 3-C4,D4 4-B3,B5,C3,C5
HA18:	1-D4 3-C2,D2
HA19:	1-D4 4-B3,B5,C3,C5
HA20:	1-D4
HA21:	1-D4
HA22:	1-D4
HA23:	1-D4
HA1-HA23:	1-D8 2-D8 3-B8 4-D8 5-B7
HD0:	1-B3,C6 3-B4 4-C2,C5 5-B6 6-B4
HD0-HD15:	1-D8 2-C8 3-A8 5-A7 6-D8 7-A8
HD1:	1-B3,C6 3-B4 4-B2,B5 5-B6 6-B4
HD2:	1-B3,C6 3-B4 4-B2,B5 5-C6 6-B4

LABEL	PAGE COORDINATES
HD3:	1-B3,C6 3-B2 4-B2,B5 5-C6 6-B4
HD4:	1-B3,C6 3-B2 4-B2,B5 5-C6 6-B4
HD5:	1-B3,C6 3-B2 4-B2,B5 5-C6 6-B4
HD6:	1-B3,C6 3-B2 4-B2,B5 5-C6 6-B4
HD7:	1-B3,C6 3-B2 4-B2,B5 5-C6 6-B4
HD8:	1-B3 2-C6 3-C4 4-D2,D5 5-C6 6-D4 7-B4
HD9:	1-B3 2-C6 3-C4 4-D2,D5 5-C6 6-D4 7-B4
HD10:	1-B4 2-C6 3-C4 4-D2,D5 5-C6 6-D4 7-B5
HD11:	1-B4 2-C6 3-C2 4-D2,D5 5-C6 6-D4 7-B5

LABEL	PAGE COORDINATES
HD12:	1-B4 2-C6 3-C2 4-D2,D5 5-C6 6-D4 7-B5
HD13:	1-B4 2-C6 3-C2 4-D2,D5 5-C6 6-D4 7-B5
HD14:	1-C4 2-C6 3-C2 4-D2,D5 5-C6 6-D4 7-B5
HD15:	1-C4 2-C6 3-C2 4-D2,D5 5-C6 6-D4 7-B5
HDPRAM_1*:	1-D1 5-D7
HOST_IRQ*:	1-B1 8-D8
HOST_RDH*:	1-B1 2-B2 3-B8 4-C8 6-A8 7-A8
HOST_RDL*:	1-A1 3-B8 4-A8 6-B8
HOST_WRH*:	1-B1 2-B2 3-B8 4-C8
HOST_WRL*:	1-B1 3-B8 4-A8
IPL0:	1-A3,B6
IPL1:	1-A3,B6
IPL2:	1-A3,B6
LDS*:	1-A1,A3,B3,B6 5-D7

LABEL	PAGE COORDINATES
MARKER_IN:	1-B8 7-A8
MARKER_RTN:	7-B1 14-C8
MINX*:	1-C1 6-C8
MINX_ENBL*:	6-D1 8-B8
MINX_IRQ*:	1-B8 6-B1
MINX_WR*:	1-C1 6-A8
MODDATACLK:	9-B8 12-D8
MODDATAIN:	9-B8 12-D8
MODDATALCH:	9-B8 12-D8
MODDATAOUT:	9-B1 12-C7
MOD_ENABLE:	9-B8 12-D8
MPU_CLK:	1-C8 7-C6 8-A8 9-B8
MPU_HALT*:	1-D8 8-D8
MPU_RESET*:	1-D8 2-C2 8-D8
MUX_ENBL*:	8-D8 11-B8
NIBP_ENBL*:	8-B8 13-C8
NIBP_IO*:	9-C1 13-B8
PGM_WE*:	3-B8 8-B8
PPT1:	1-B5
PPT2:	1-B5
PPT3:	1-B5
PPT5:	1-D2
PPT6:	1-C2
PPT7:	1-C2
PPT8:	1-C2
PPT9:	1-C2
PPT10:	1-C2

LABEL	PAGE COORDINATES
PPT11:	2-C4
PPT12:	3-D6
PPT13:	3-D6
PPT14:	5-D5
PPT16:	5-D4
PPT18:	6-D2
PPT19:	6-C2
PPT20:	8-B7
PPT21:	8-B6
PPT22:	8-B2
PPT23:	8-B2
PPT24:	9-D3
PPT25:	9-D3
PPT26:	9-D3
PPT27:	9-C3
PPT28:	9-C3
PPT29:	10-B6
PPT30:	10-B4
PPT31:	10-B4
PPT32:	10-C6
PPT33:	10-D5
PPT34:	10-D4
PPT35:	10-D3
PPT36:	10-D2
PPT37:	11-C5
PPT38:	11-C4
PPT41:	12-A8
PPT42:	12-A8
PPT43:	12-A8
PPT44:	15-B2
PPT45:	15-B2
PPT46:	15-A2
PPT47:	15-B1
PPT48:	15-B1
PULSE_IRQ*:	1-B8 6-C1
PWRBUS:	6-C2 12-B3 13-D3 14-C3,C8
PWRRTN:	6-D2

18 of 20

8 7 6 5 4 3 2 1

D C B A

LABEL	PAGE COORDINATES
R/W*:	1-A1,A3,B3,C3 5-D7 6-C8
RD0-RD15:	4-D8
RED/GREEN*:	8-B8 11-A8
RESP/ECGV:	11-C1 12-D3
RTC_IRQ*:	1-B8 2-C2
SA/D0:	5-B4,C4 8-B2,B5,C2 10-C6,D2,D3,D5,D6 11-C7,D7 13-B6
SA/D0-SA/D7:	5-A2 8-D1 10-D8 11-D8 13-C8
SA/D1:	5-B4,C4 8-B2,B5,C2 10-C6,D2,D3,D5,D6 11-C7,D7 13-B6
SA/D2:	5-C4 8-B2,B5,D2 10-C6,D2,D3,D5,D6 11-C7,D7 13-B6
SA/D3:	5-C4 8-B2,B5,D2 10-C6,D2,D3,D5,D6 11-C7,D7 13-C6
SA/D4:	5-C4 8-B2,B5,D2 10-C6,D2,D3,D5,D6 11-C7,D7 13-C6
SA/D5:	5-C4 8-B5,C2,D2 10-C6,D2,D3,D5,D6 11-C7,D7 13-C6
SA/D6:	5-C4 8-B5,C2,D2 10-C6,D2,D3,D5,D6 11-C7,D7 13-C6

LABEL	PAGE COORDINATES
SA/D7:	5-C4 8-B5,C2,D2 10-C6,D2,D3,D5,D6 11-C7,D7 13-C6
SA0:	8-B3,C3 9-B6 13-A7
SA0-SA15:	5-B2 8-D1 9-D8 13-B8
SA1:	5-C3 8-B3,C3 9-B6 13-A7
SA2:	5-C3 8-B3,D3
SA3:	5-C3 8-B3,D3
SA4:	5-C3 8-B3,D3
SA5:	5-D3 8-B3,D3
SA6:	5-D3 8-B3,D3
SA7:	5-D3 8-B3,D3
SA8:	5-D3 8-B3,C5,D3
SA9:	5-D3 8-B3,C5,D3 9-B6
SA10:	5-D3 8-C3,C5,D3 9-B6
SA11:	5-D3 8-C3,C5,D3 9-B6
SA12:	5-D3 8-C3,C5,D3 9-B6
SA13:	8-C3,C5,D3 9-B6
SA14:	8-C3,C5,D3 9-B6
SA15:	8-C5 9-D6
SCC_BOOT*:	8-C1 9-C1

LABEL	PAGE COORDINATES
SCC_GDEN*:	8-C8 9-B8
SCC_GRXD:	8-C8 9-C8
SCC_GTXD:	8-C8 9-B8
SCC_IRQ*:	1-B8 8-D8
SCC_LRXD:	8-C8 9-B1
SCC_LTXD:	8-C8 9-B1
SCC_RD*:	5-D2 8-D1 9-A1 13-B8
SCC_RESET*:	8-A8 10-B1 11-B8
SCC_SEM*:	5-D2 9-D8
SCC_SRAM*:	8-D1 9-D1
SCC_WR*:	5-D2 8-D1 9-A1 11-C8 13-B8
SDI:	8-C8 14-B5
SDO:	8-C8 14-B5
SDPRAM2*:	5-D2 9-B1
SDPRAM3*:	5-D2 9-B1
SEM*:	1-D1 5-D7
SER_CMD*:	8-C8 14-B5
SHUTDOWN:	8-C8 14-B5
SR0_RD*:	9-C1 10-D8
SR0_WR*:	9-C1 10-C1
SR1_RD*:	9-C1 10-C8
SR1_WR*:	9-D1 10-C1

LABEL	PAGE COORDINATES
SR2_WR*:	9-D1 10-C1
SR3_WR*:	9-D1 10-C1
SRAM_4*:	1-D1 4-B8
SRAM_5*:	1-D1 4-B8
SRAM_EN*:	4-A8 10-B1
SR_CLK:	9-B1 10-C8
SR_RECIRC:	9-B1 10-C1
STROBE*:	8-C8 14-B5
SYNCECGRTN:	11-C1 12-D3
SYNCPULSE*:	8-D8 11-B8
SYNC_ECG:	11-C1 12-D3
TMR_CLK:	2-C2 7-D6
TRC1/ECGI1:	11-C1 12-D3
TRC2/ECGI:	11-C1 12-D3
UDS*:	1-A1,A3,B3,C3 5-D7
VPP_ENBL*:	3-D8 8-B8
VPP_LOW*:	3-D8 8-B8
W/R*:	1-A1 5-D7
WATCHDOG*:	8-D8 10-B1

19 of 20

REFDES	PAGE COORDINATES
U1:	1-D7
U2:	1-B7
U3:	1-D5
U4:	1-D3
U5:	1-B3,C2 6-C2,D2
U6:	1-B2
U13:	2-C5
U14:	3-B7 6-A5
U15:	3-D7
U16:	3-D4
U17:	3-C4
U29:	4-D5
U30:	4-C5
U31:	4-D3
U32:	4-C3
U33:	4-B7
U36:	5-D5
U40:	6-D4
U43:	6-B4
U44:	7-D8
U45:	7-D7
U47:	7-B5
U48:	8-D7
U49:	8-B5
U50:	8-C5
U51:	8-D3
U52:	8-C3
U54:	9-B6
U55:	9-D4
U56:	9-C2,D2
U57:	10-D7
U58:	10-C7
U59:	10-D5
U60:	10-D4
U61:	10-D3
U62:	10-D2
U63:	10-B5
U64:	11-D6
U65:	11-C6
U66:	9-D3 11-A6,A7,B5,B6,D5
U67:	11-D4
U68:	12-B7,D4
U69:	13-C5
U72:	14-D7
U73:	9-C2 11-C7,D7

REFDES PAGE COORDINATES

REFDES PAGE COORDINATES

20 of 20

CONNECTOR	SIGNAL
J1-1:	PPT18
J1-2:	PPT19
J1-4:	GND
J1-6:	GND
J1-8:	GND
J1-12:	GND
J1-17:	PWRRTN
J1-18:	PWRBUS
J1-19:	PWRRTN
J1-20:	PWRBUS
J1-22:	GND
J1-24:	GND
J1-26:	GND
J1-27:	06081019
J1-28:	06011025
J1-29:	06081020
J1-30:	06011022
J1-31:	GND
J1-32:	06011012
J1-33:	GND
J1-34:	06011010
J1-35:	06081023
J1-36:	06011007
J1-37:	GND
J1-38:	06011015
J1-39:	GND
J1-40:	06011017
J1-41:	06081026
J1-42:	06011020
J1-43:	06081027
J1-44:	MINX_IRQ*
J1-45:	06011053
J1-46:	06062061
J1-47:	06011051
J1-48:	06011048
J1-49:	06011046
J1-50:	06062065
J1-51:	06011041
J1-53:	06011036
J1-54:	06081044
J1-55:	06011038
J1-57:	06011043
J1-58:	+5.0
J1-59:	5VAGND
J1-60:	-5.0
J1-61:	+5
J1-62:	+5
J1-63:	GND
J1-64:	GND

CONNECTOR	SIGNAL
J2-1:	PWRBUS
J2-2:	PWRBUS
J2-3:	+16.5
J2-4:	+16.5
J2-5:	PWRRTN
J2-6:	PWRRTN
J2-7:	14050016
J2-8:	14050020
J2-9:	14050007
J2-10:	14050011
J2-11:	14020033
J2-12:	GND
J2-13:	14020035
J2-14:	GND
J2-17:	14020045
J2-18:	GND
J2-19:	14020048
J2-20:	GND
J2-21:	14016058
J2-24:	GND
J2-25:	BATT_ID*
J2-26:	SDI
J2-27:	SDO
J2-28:	CLK
J2-29:	SER_CMD*
J2-30:	STROBE*
J2-31:	GND
J2-32:	+5
J2-33:	BATT_NC1
J2-34:	BATT_NC2
J2-35:	SHUTDOWN
J2-36:	CLR
J3-1:	PWRBUS
J3-2:	PWRBUS
J3-3:	PWRRTN
J3-4:	PWRRTN
J3-7:	GND
J3-8:	14091033
J3-9:	GND
J3-10:	14091036
J3-11:	+5
J3-12:	14091039
J3-13:	+5
J3-14:	14086011

CONNECTOR	SIGNAL
J4-1:	PWRBUS
J4-2:	PWRRTN
J4-3:	PWRBUS
J4-4:	PWRRTN
J4-5:	13078035
J4-7:	13082036
J4-8:	+5
J4-9:	13078037
J4-10:	GND
J4-11:	13082038
J4-12:	13031005
J4-13:	13078039
J4-14:	13044008
J4-15:	13082040
J4-16:	13080048
J4-17:	13078041
J4-18:	13080055
J4-19:	13082042
J4-20:	13080052
J4-21:	13080062
J4-22:	13080059
J5-1:	12090018
J5-2:	12093008
J5-3:	12094020
J5-4:	12090005
J5-5:	12090022
J5-6:	12094024
J5-7:	12093013
J5-8:	12090010
J5-9:	12090015
J5-10:	PPT41
J5-12:	GND
J5-13:	-12.8
J5-14:	GND
J5-15:	+12.8
J5-16:	+5.0
J5-17:	5VAGND
J5-18:	-5.0
J5-19:	5VAGND
J5-20:	12012032
J5-21:	12012020
J5-22:	12012022
J5-23:	12012017
J5-24:	GND
J5-25:	12012034
J5-26:	GND
J5-27:	12012025
J5-28:	12012037
J5-29:	+5
J5-30:	12012054
J5-31:	+5
J5-32:	PPT42
J5-33:	+15.5
J5-34:	PWRRTN
J5-35:	PWRRTN
J5-36:	+16.5
J5-37:	+16.5
J5-38:	PPT43
J5-39:	PWRBUS
J5-40:	PWRBUS

CONNECTOR	SIGNAL

Assembly Revisions PN 800210

The baseline revision for this assembly is pn 800210-005B. To convert the parts list back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 800210-001E

This version of the assembly was used first in all of the A-series Tram modules. The corresponding parts location diagram, pn 800210-001E/002B, and schematic diagram, SD800210-001C, are found later in this chapter.

PN 800210-002B

This version of the assembly replaced all processor PCBs in the A and SL-series Tram modules. The corresponding parts location diagram, pn 800210-001E/002B, and schematic diagram, SD800210-001C, are found later in this chapter.

PN 800210-005A

This version of the assembly replaced all -001/002 processor PCBs in all Tram modules.

Item	Description	Revision's Part Number	Baseline Part Number	Qty
C1	Cap, NPO, 47pF, 5%, 50V, SM	411576-008	411576-019	1
–	Schematic Diagram	800210-005A	800210-005B	

Parts List PN 800210-001E/002B

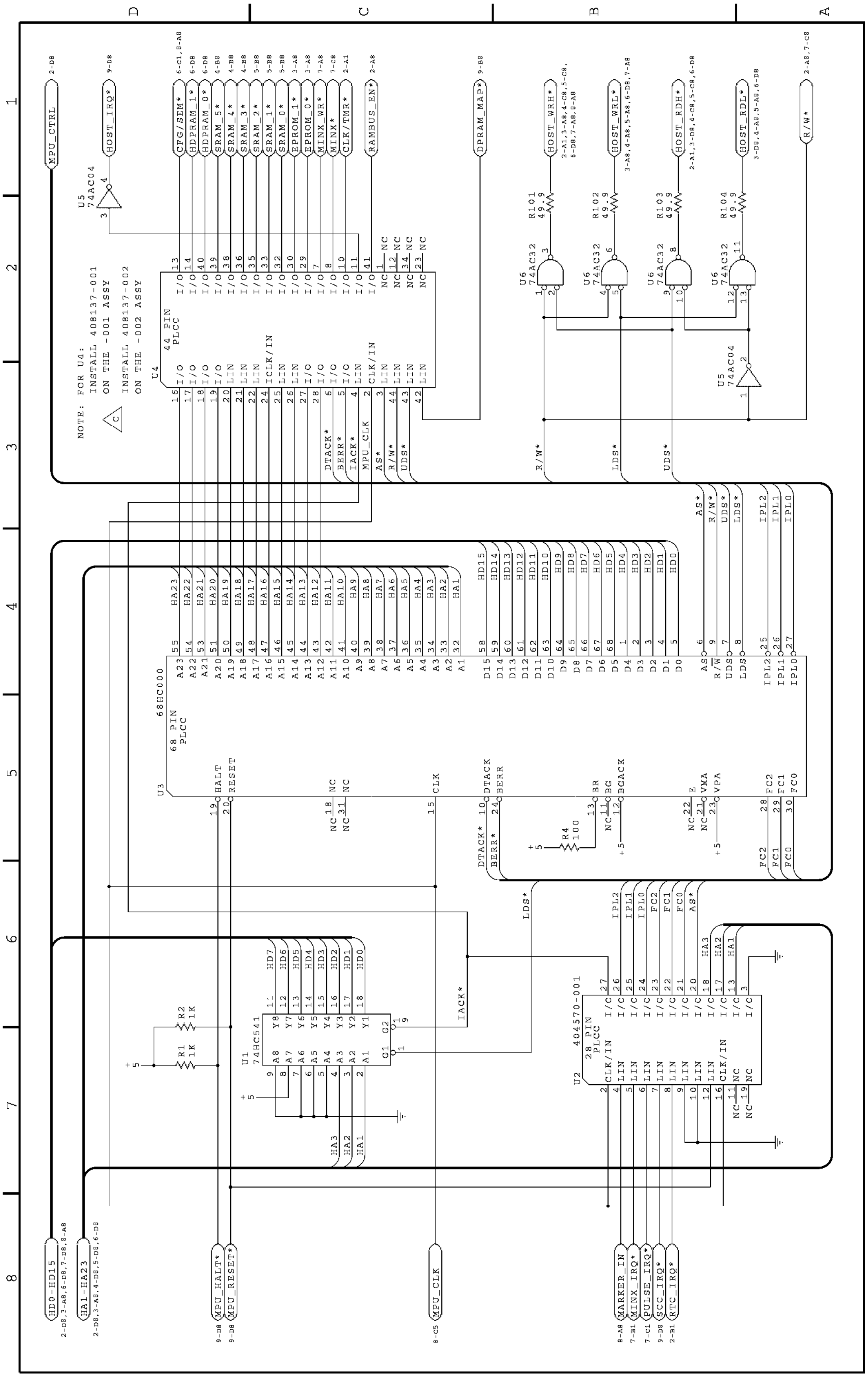
Item	Parts List	Part Number	Qty
BTI	Battery, 3V, Lithium, Coin-Type	401981-001	1
C1	Cap, Cer, 47pF, 5%, 50V, SM	1181-470	1
C2	Cap, Var, 4 - 25pF, SM	401977-001	1
C3, 6, 7, 10, 11, 17, 19,23, 25, 27, 29, 31-37,42, 43, 46-49, 61-65,72, 73, 74, 78, 79, 80,83-94, 96, 98, 99	Cap, Cer, 0.1µF, 20%, 50V	404370-001	50
C4, 97	Cap, Cer, 0.01µF, 5%, 50V, SM	1182-103	2
C5, 24, 26	Cap, Tant, 4.7µF, 20%, 20V, SM	402004-001	3
C12, 20, 21, 28, 30	Cap, Tant, 10µF, 20%, 10V, SM	1176-106	5
C13, 14, 15, 18, 38, 39,76	Cap, Cer, 0.47µF, 20%	1187-474	7
C16, 40, 41, 44, 45, 68-71, 75, 77, 81, 82, 95	Cap, Cer, 0.22µF, 20%, 50V, SM	1187-224	14
C22	Cap, Tant, 10µF, 20%, 25V, SM	1152-106	1
C100, 101, 102	Cap, Cer, 0.001µF, 5%, 50V, SM	1181-102	3
CR1, 6	Diode, Schottky, SM BAT54	401985-001	2
CR2, 10-13	Diode Pair, Series, SM D7000	2013-201	5
CR3	Diode, Transient Voltage Suppression, SM P6SMB20AT1	403939-001	1
CR5	Diode, SM MMAD4148	401980-001	1
CR8, 9	Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3	403187-001	2
CR14, 15	Diode, Transient Voltage Suppressor, Bidirectional, 6.8V, 600W	404121-001	2
DS1	Diode, Light-Emitting (Red/Green) LDGR 2340	402428-001	1
J1	Connector, PC Header, 64-Pin	1847-064	1
J2	Connector, PC Header, 24-Pin, Vertical	1778-224	1
J3	Connector, PC Header, 14-Pin	408623-001	1
J4	Connector, PC Header, 22-Pin	408623-002	1
J5	Connector, PC Header, 40-Pin	1778-240	1
Q1, 2, 3, 6, 7-10, 14, 16, 18, 19	Transistor, NPN, SM T3904	2511-001	12
Q4, 5	Transistor, NPN, SM BCX56-1	2712-056	2
Q11	Transistor, PNP, SM T4403	401978-001	1
Q13, 15, 17	Transistor, PNP, SM T3906	2511-101	3
R1, 2, 30, 31, 32, 57, 69, 70	Res, Cer, 1K, 1%, 1/8W, SM	1082-103	8
R3, 7, 35, 47, 48, 72, 101-104	Res, Cer, 49.9Ω, 1%, 1/8W, SM	1082-799	10
R4, 28	Res, Cer, 100Ω, 1%, 1/8W, SM	1082-755	2
R5, 9, 25, 29, 34, 36, 82-85	Res, Cer, 100K, 1%, 1/8W, SM	1082-100	10

Item	Parts List	Part Number	Qty
R6, 10, 11, 12, 22, 23, 24, 26, 27, 37-41, 44, 52, 53, 59, 68, 88, 98	Res, Cer, 10K, 1%, 1/8W, SM	1082-104	22
R8, 46, 90, 92	Res, Cer, 1.5K, 1%, 1/8W, SM	1082-768	4
R13	Res, Cer, 200K, 0.1%, 1/8W, SM	1067-832	1
R14	Res, Cer, 22.9K, 0.1%, 1/8W, SM	1067-833	1
R19, 20	Res, 0Ω, SM	1082-756	2
R21, 60, 61, 62, 93-97	Res, Cer, 150Ω, 1%, 1/8W, SM	1082-767	9
R42, 43	Res, Cer, 47.5K, 1%, 1/8W, SM	1082-757	2
R45, 49, 54	Res, Cer, 3.4K, 1%, 1/8W, SM	1082-759	3
R50, 55, 56	Res, Cer, 34.8K, 10%, 1/4W, SM	1082-791	3
R51	Res, Cer, 249Ω, 1%, 1/8W, SM	1082-793	1
R63	Res, Cer, 2.4M, 5%, 1/8W, SM	1081-484	1
R64	Res, Var, 500K, Top Adjust	401979-001	1
R65	Res, Cer, 3.9M, 5%, 1/8W, SM	1081-485	1
R66	Res, Cer, 200Ω, 1%, 1/8W, SM	1082-762	1
R67	Res, Cer, 22M, 5%, 1/8W, SM	1081-486	1
R71, 99	Res, Cer, 340Ω, 1%, 1/8W, SM	1082-790	2
R73-77, 89, 91, 100	Res, Cer, 4.75K, 1%, 1/8W, SM	1082-760	8
R78-81	Res, Cer, 750Ω, 1%, 1/8W, SM	1082-764	4
S1	Switch, Dual In-Line, 6-Station, SM	401960-001	1
U1, 47	Buffer/Driver, Octal, SM HC541	401974-001	2
U2	EPLD, 68000 Interrupt Encoder, PLCC	404570-001	1
U3	Microprocessor, 16-MHz, PLCC 68HC000	401968-001	1
U4	EPLD, 68000 Bus Control, PLCC	408137-001	1
U5	Inverter, Hex, SM AC04	3062-004	1
U6, 14, 33, 56, 73	OR Gate, 2-Input, Quad, SM AC32	3062-032	5
U7, 10, 11, 12	Res Ntwk, 100K, SM	1061-104	4
U8, 9, 40	Transceiver, Bus, Octal, SM ACQ245	408019-001	3
U13	Clock/Timer, SM DP8570	401970-001	1
U15	Volt Rgltr, Adj, SM LP2951A	3076-001	1
U16, 17	EEPROM, Flash, 2K x 8-Bit, 150nS, PLCC 28F020 (For -001 Only)	405858-002	2
U16, 17	EEPROM, Flash, 2K x 8-Bit, 150nS, PLCC 28F020 (For -002 Only)	408792-002	2
U29-32	RAM, Static, 128K x 8-Bit, 100nS 628128L	406255-001	4
U36	RAM, Dual Port, 4k x 8-Bit, 70nS, PLCC IDT7134	404007-002	1
U37	RAM, Dual-Port, 4k x 8-Bit, w/Arbitration Logic, 70nS, PLCC IDT71342	408123-001	1
U38, 41, 71	Res Ntwk, 100Ω	1062-101	3
U39	Res Ntwk, 10K	1061-103	1
U43	Buffer/Driver, Octal, SM AC541M	401973-001	1
U44	Oscillator, CMOS, 14.7456MHz, SM	401480-001	1
U45	Flip-Flop, Type D, Dual, SM HC74	3038-074	1

Item	Parts List	Part Number	Qty
U46	Data Selector, 1-Line-of-4-Line, Three-State Output, Dual/Multiplexer, 4-Line-to-1-Line, Three-State Output, Dual, SM AC253	404012-001	1
U48	PAL, Programmed, Communication Control, PLCC 80C152JB	400368-001	1
U49	Latch, Transparent, Three-State Output, Octal, SM HC573	401971-001	1
U50	AND Gate, 2-Input, Quad, SM AC08	402717-001	1
U51	RAM, Static, 32K x 8-Bit, SM 62256FLP	3202-256	1
U52	EPROM, Programmed, 80C152 Boot Code, PLCC	404904-002	1
U53, 70	Res Ntwk, 10K	1062-103	2
U54	EPLD, 80C152 Communication Interface, PLCC	408139-001	1
U55	Decoder/Demultiplexer, 4-Line-to-16-Line, SM HC154	404210-001	1
U57, 58	Shift Register, 8-Bit, Serial Input, Serial/Parallel Output, Tri-State Output, SM HC595	401969-001	2
U59-62	Shift Register, Parallel Load, 8-Bit, SM HC165	401972-001	4
U63	Microprocessor Support Circuit, SM MAX695	401966-001	1
U64, 65	Register, 8-Bit, SM HC273	3038-273	2
U66	Inverter, Hex, SM HC04	3038-004	1
U67	Hybrid, Analog Output	401205-001	1
U68	Buffer, Tri-State Output, Hex, SM HC367	401967-001	1
U69	Transceiver, Bus, Octal, SM HC245	401963-001	1
U72	Line Driver/Receiver, Differential, SM DS8921AM	404013-001	1
W1, 2, 3	Socket, Mini	1818-201	7
Y1	Crystal, 32.768kHz, SM	402085-001	1
-	Connector, Header, Male/Male, 64-Pin (for J1)	409203-001	1
-	Jumper, Mini (for W1, W3)	1859-201	2
-	Lubricant, Anti-Fretting (for U67)	410286-001	AR
-	Mounting Pad, Battery (for BT1)	404368-001	1
-	Socket, Hybrid (for U67)	404596-001	2
-	Socket, PLCC, 28-Pin, SM (for U2) (For -001 Only)	402413-001	1
-	Socket, PLCC, 32-Pin, SM (for U52) (For -001 Only)	403802-001	1
-	Socket, PLCC, 44-Pin, SM (for U4, 54) (For -001 Only)	402412-001	2
-	Socket, PLCC, 68-Pin, SM (for U48)	402411-001	1
-	Circuit Board	800211-001C	1
-	Schematic Diagram	SD800210-001C	–

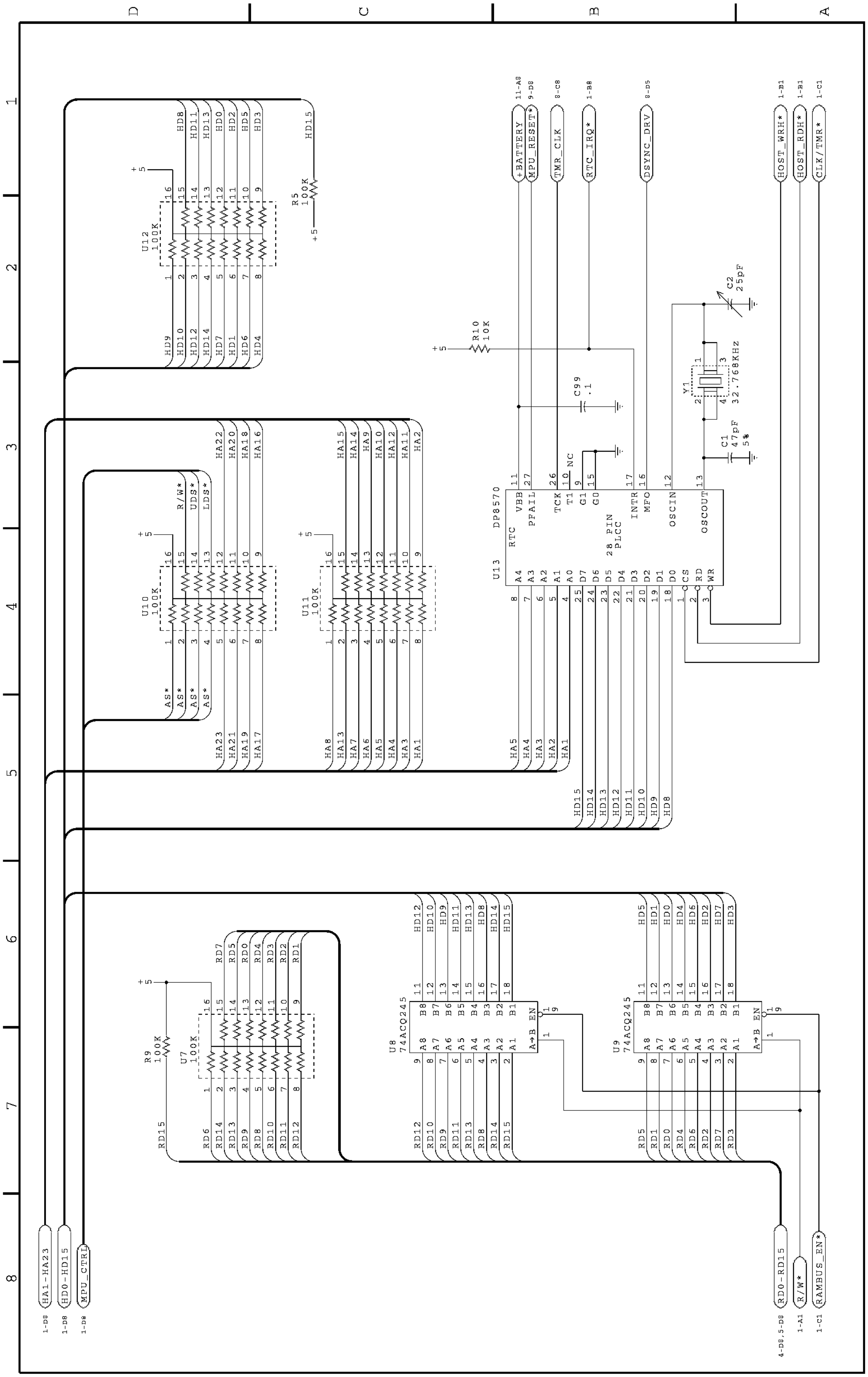
Schematic Diagram PN SD800210-001C

1 of 18

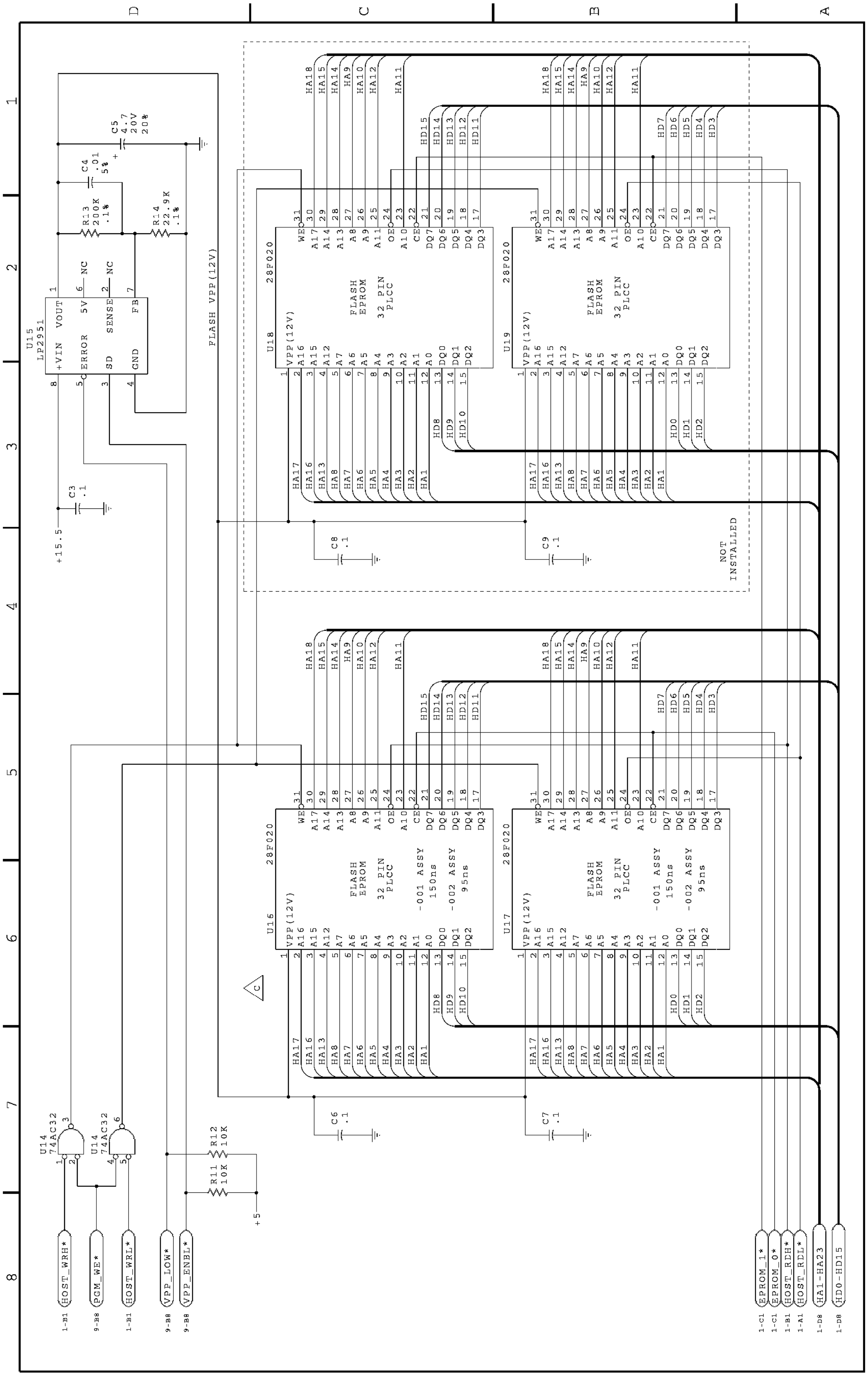


MPU_CTRL
HOST_IRQ*
CPG/SEM*
HDPRAM_1*
HDPRAM_0*
SRAM_5*
SRAM_4*
SRAM_3*
SRAM_2*
SRAM_1*
SRAM_0*
EPROM_1*
EPROM_0*
MINX_WR*
MINX*
CLK/TMR*
RAMBUS_EN*
DPRAM_MAP*
HOST_WRH*
HOST_WRL*
HOST_RDH*
HOST_RDL*
R/W*
U5 74AC04
U6 74AC32
R101 49.9
R102 49.9
R103 49.9
R104 49.9
NOTE: FOR U4: INSTALL 408137-001 ON THE -001 ASSY
INSTALL 408137-002 ON THE -002 ASSY
U4 44 PIN PLCC
DTACK*
BERR*
IACK*
MPU_CLK
AS*
UDS*
LDS*
U3 68 PIN PLCC 68HC000
HALT
RESET
CLK
DTACK
BERR
BR
BG
BGACK
E
VMA
VPA
FC2
FC1
FC0
IPL2
IPL1
IPL0
R4 100
U1 74HC541
R1 1K
R2 1K
U2 28 PIN PLCC 404570-001
HD0-HD15
HA1-HA23
MPU_HALT*
MPU_RESET*
MPU_CLK
MARKER_IN
MINX_IRQ*
PULSE_IRQ*
SCC_IRQ*
RTC_IRQ*

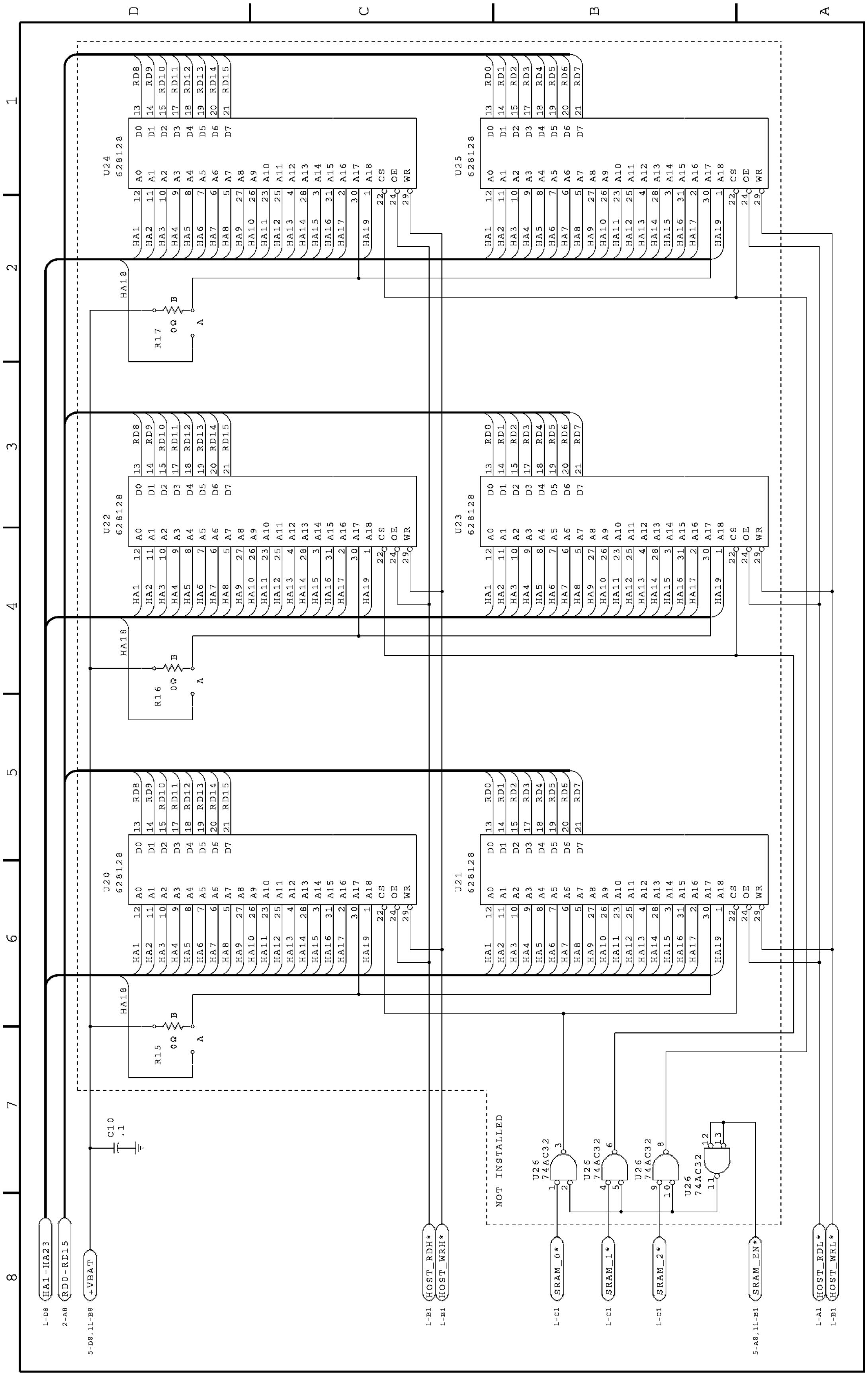
2 of 18


D
C
B
A
1
2
3
4
5
6
7
8
U12
100K
R5
100K
U10
100K
U11
100K
U13
DP8570
RTC
28 PIN
PLCC
R10
10K
C99
.1
C1
47pF
5%
C2
25pF
Y1
32.768KHz
R9
100K
U7
100K
U8
74ACQ245
U9
74ACQ245
+BATTERY
MPU_RESET*
TMR_CLK
RTC_IRQ*
DSYNC_DRV
HOST_WRH*
HOST_RDH*
CLK/TMR*
HA1-HA23
HD0-HD15
MPU_CTRL
RD0-RD15
R/W*
RAMBUS_EN*
11-A8
9-D8
8-C8
1-B8
8-D5
1-B1
1-C1
1-D8
4-D8,5-D8
1-A1
VBB
PFAIL
TCK
T1
G1
G0
INTR
MFO
OSCIN
OSCOUT
A4
A3
A2
A1
A0
D7
D6
D5
D4
D3
D2
D1
D0
CS
RD
WR
NC
A→B
EN
AS*
R/W*
UDS*
LDS*

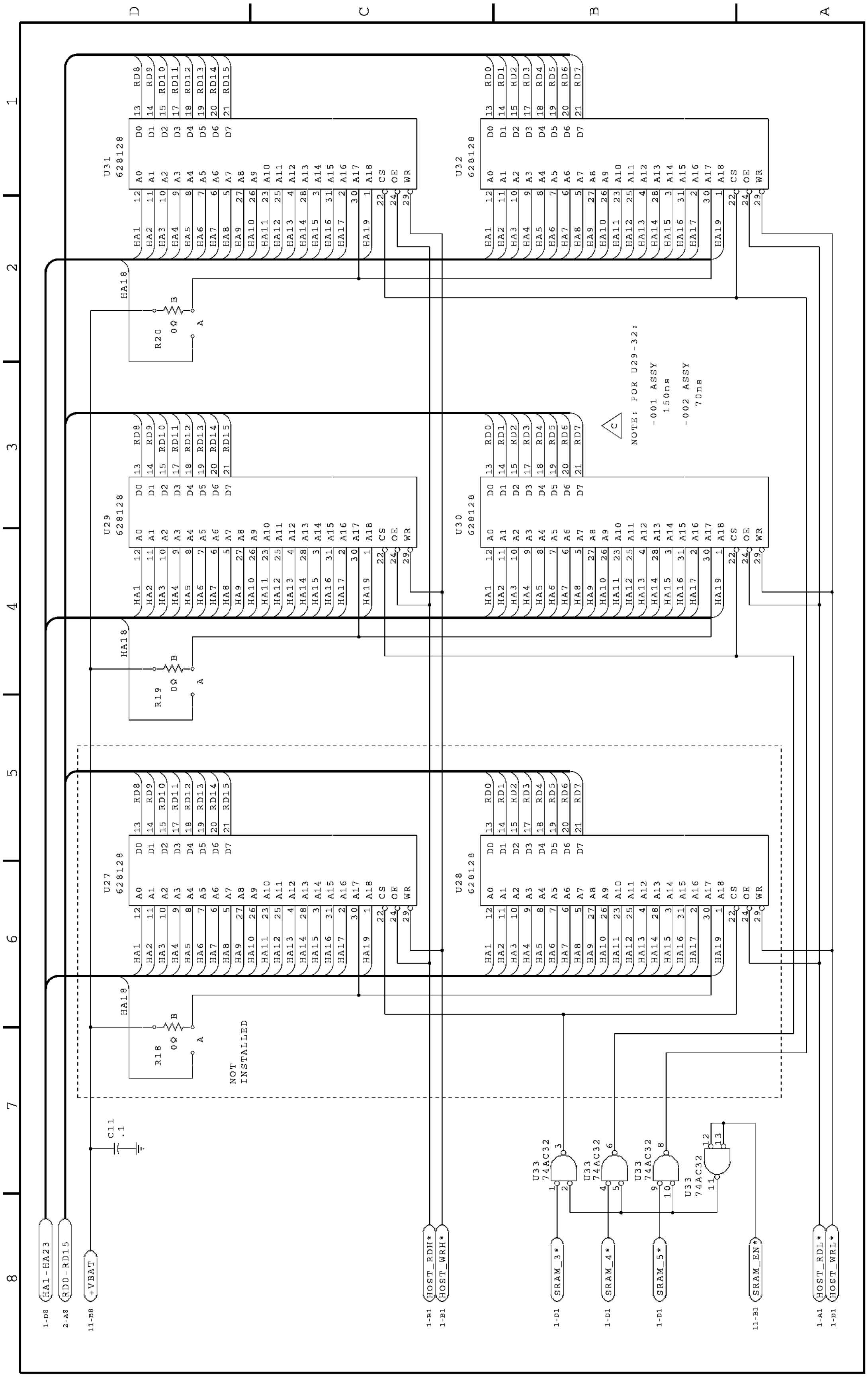
3 of 18


U15
LP2951
+VIN
VOUT
5V
SENSE
FB
ERROR
SD
GND
NC
C5 4.7 20V 20%
C4 .01 5%
R13 200K .1%
R14 22.9K .1%
C3 .1
+15.5
FLASH VPP(12V)
U18 28F020
U19 28F020
U16 28F020
U17 28F020
FLASH EPROM
32 PIN PLCC
-001 ASSY 150ns
-002 ASSY 95ns
VPP(12V)
WE
OE
CE
C8 .1
C9 .1
C6 .1
C7 .1
NOT INSTALLED
U14 74AC32
R11 10K
R12 10K
+5
HOST_WRH*
PGM_WE*
HOST_WRL*
VPP_LOW*
VPP_ENBL*
EPROM_1*
EPROM_0*
HOST_RDH*
HOST_RDL*
HA1-HA23
HD0-HD15
1-B1
9-B8
1-C1
1-A1
1-D8
D
C
B
A
1
2
3
4
5
6
7
8

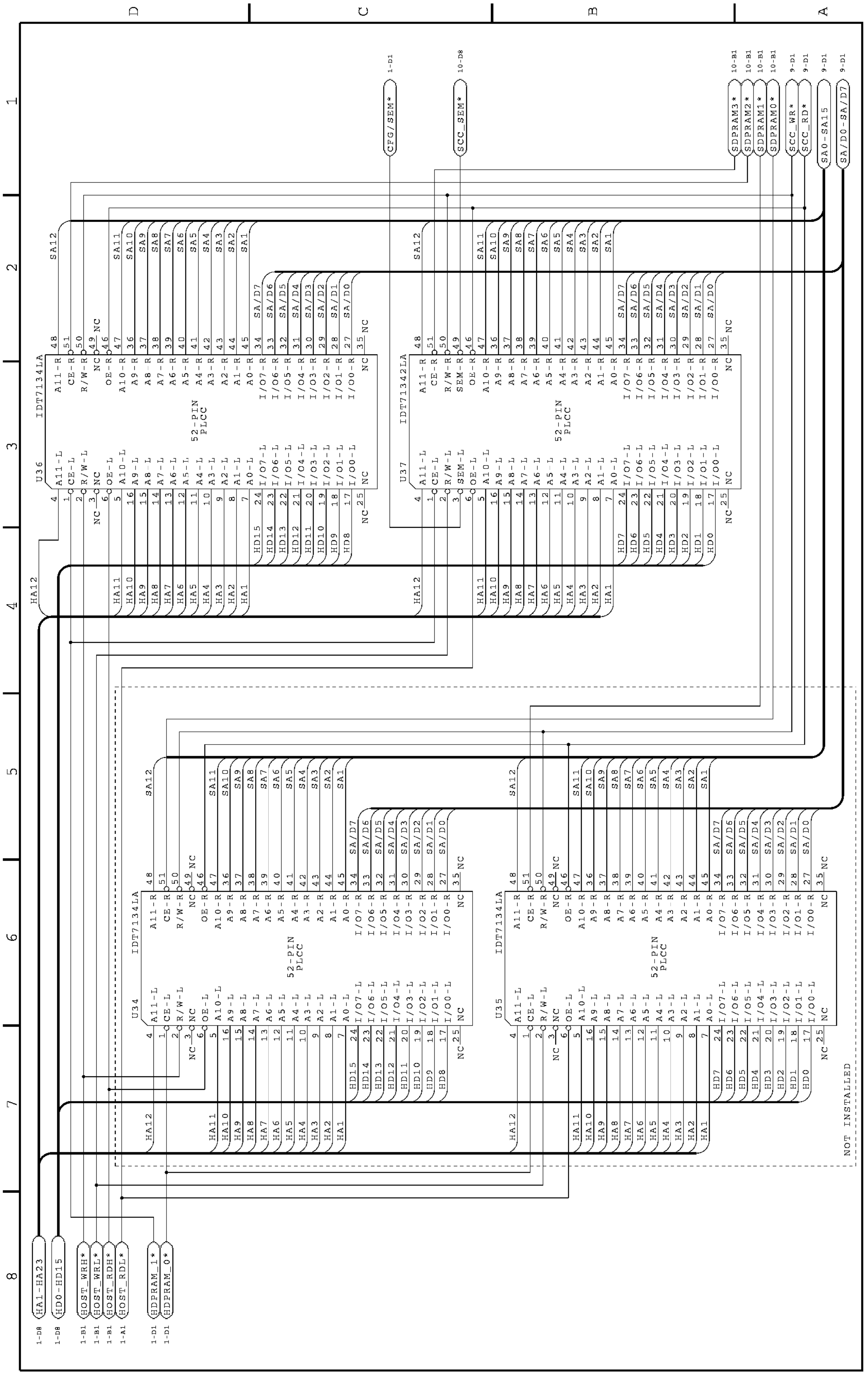
4 of 18


D
C
B
A
1
2
3
4
5
6
7
8
U24
628128
U25
628128
U22
628128
U23
628128
U20
628128
U21
628128
R17
0Ω
R16
0Ω
R15
0Ω
HA18
C10
.1
U26
74AC32
NOT INSTALLED
HA1-HA23
RD0-RD15
+VBAT
HOST_RDH*
HOST_WRH*
SRAM_0*
SRAM_1*
SRAM_2*
SRAM_EN*
HOST_RDL*
HOST_WRL*
1-D8
2-A8
5-D8,11-B8
1-B1
1-C1
5-A8,11-B1
1-A1

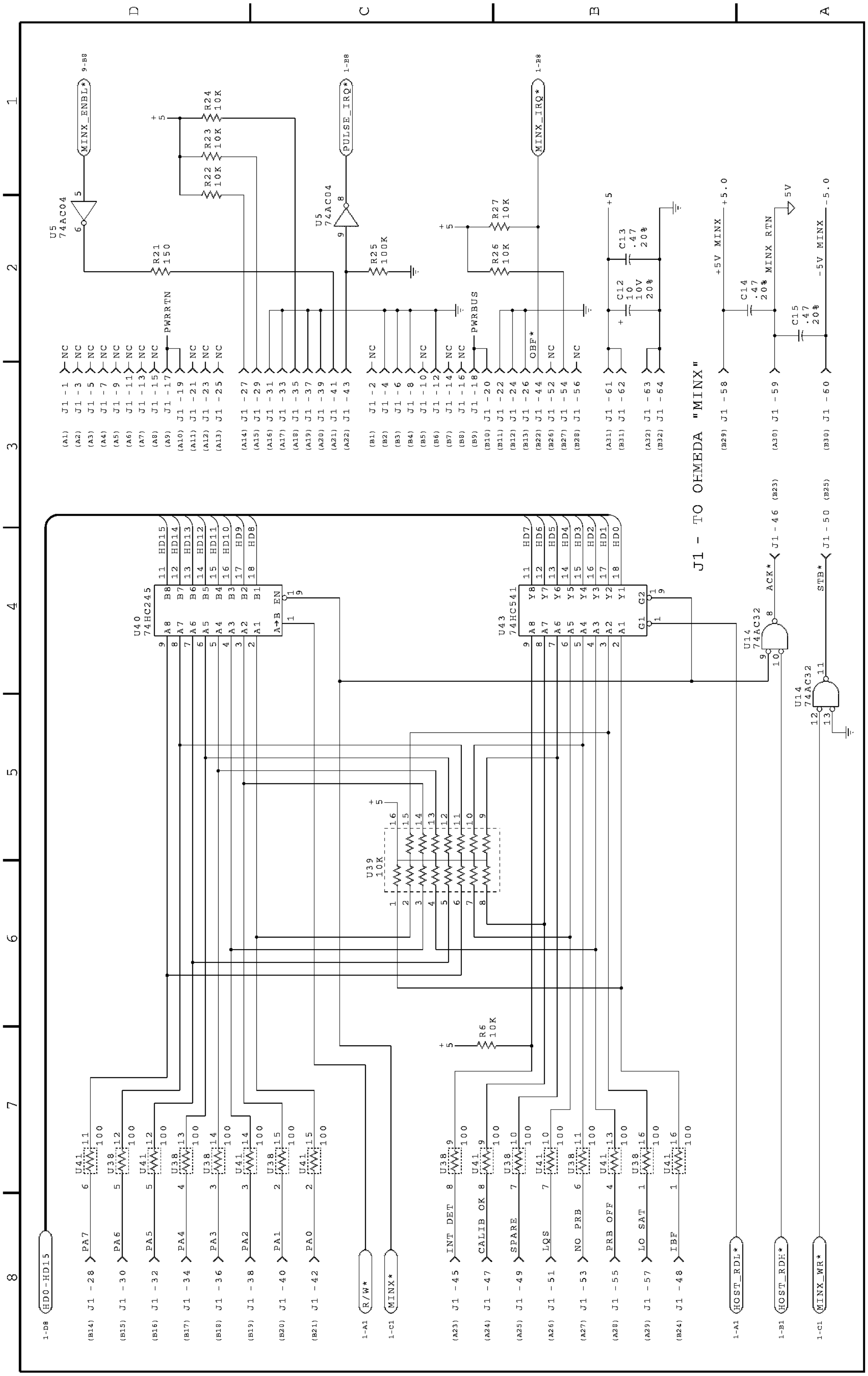
5 of 18


U31
628128
U32
628128
U29
628128
U30
628128
U27
628128
U28
628128
R20
0Ω
R19
0Ω
R18
0Ω
HA18
C11
.1
U33
74AC32
NOTE: FOR U29-32:
-001 ASSY
150ns
-002 ASSY
70ns
C
NOT
INSTALLED
HA1-HA23
RD0-RD15
+VBAT
HOST_RDH*
HOST_WRH*
SRAM_3*
SRAM_4*
SRAM_5*
SRAM_EN*
HOST_RDL*
HOST_WRL*
1-D8
2-A8
11-B8
1-B1
1-B1
1-D1
1-D1
1-D1
11-B1
1-A1
1-D1
D
C
B
A
1
2
3
4
5
6
7
8

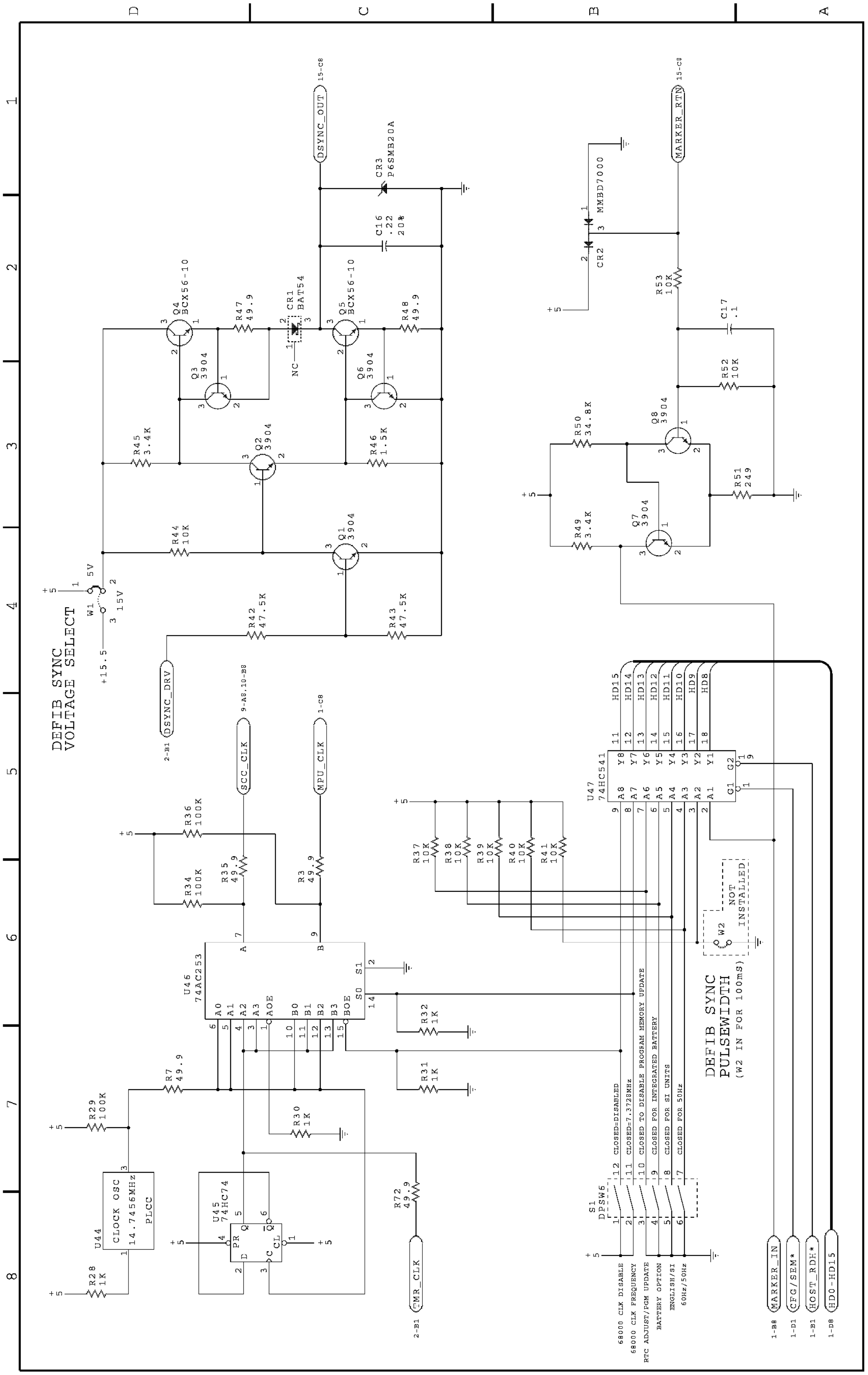
6 of 18


D
C
B
A
1
2
3
4
5
6
7
8
U36
IDT7134LA
52-PIN PLCC
U37
IDT71342LA
52-PIN PLCC
U34
IDT7134LA
52-PIN PLCC
U35
IDT7134LA
52-PIN PLCC
NOT INSTALLED
A11-L
CE-L
R/W-L
SEM-L
OE-L
A10-L
A9-L
A8-L
A7-L
A6-L
A5-L
A4-L
A3-L
A2-L
A1-L
A0-L
I/O7-L
I/O6-L
I/O5-L
I/O4-L
I/O3-L
I/O2-L
I/O1-L
I/O0-L
A11-R
CE-R
R/W-R
SEM-R
OE-R
A10-R
A9-R
A8-R
A7-R
A6-R
A5-R
A4-R
A3-R
A2-R
A1-R
A0-R
I/O7-R
I/O6-R
I/O5-R
I/O4-R
I/O3-R
I/O2-R
I/O1-R
I/O0-R
NC
SA12
SA11
SA10
SA9
SA8
SA7
SA6
SA5
SA4
SA3
SA2
SA1
SA/D7
SA/D6
SA/D5
SA/D4
SA/D3
SA/D2
SA/D1
SA/D0
HA12
HA11
HA10
HA9
HA8
HA7
HA6
HA5
HA4
HA3
HA2
HA1
HD15
HD14
HD13
HD12
HD11
HD10
HD9
HD8
HD7
HD6
HD5
HD4
HD3
HD2
HD1
HD0
CFG/SEM* 1-D1
SCC_SEM* 10-D8
SDPRAM3* 10-B1
SDPRAM2* 10-B1
SDPRAM1* 10-B1
SDPRAM0* 10-B1
SCC_WR* 9-D1
SCC_RD* 9-D1
SA0-SA15 9-D1
SA/D0-SA/D7 9-D1
HA1-HA23 1-D8
HD0-HD15 1-D8
HOST_WRH* 1-B1
HOST_WRL* 1-B1
HOST_RDH* 1-B1
HOST_RDL* 1-A1
HDPRAM_1* 1-D1
HDPRAM_0* 1-D1

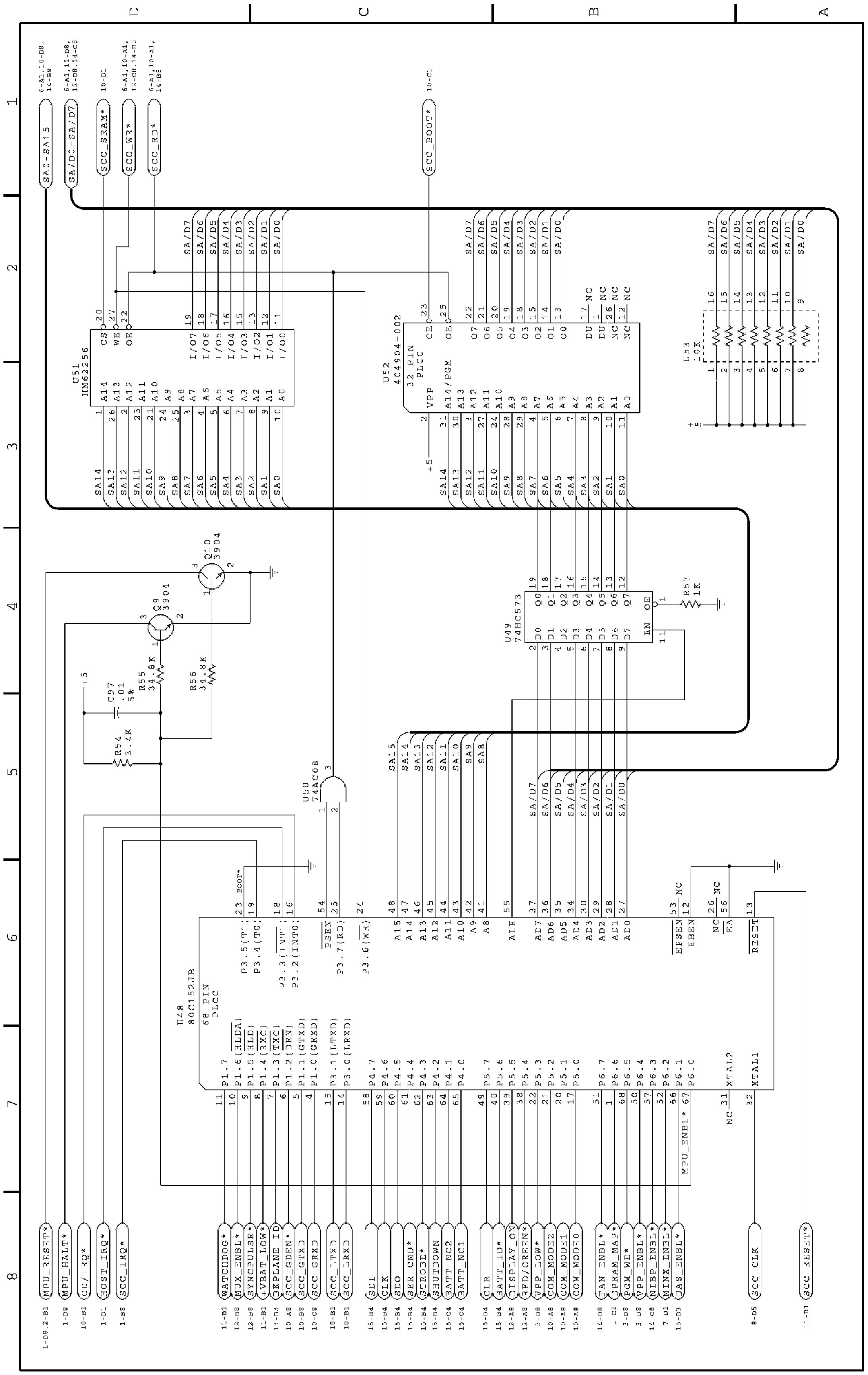
7 of 18


J1 - TO OHMEDA "MINX"
D
C
B
A
1
2
3
4
5
6
7
8
MINX_ENBL*
PULSE_IRQ*
MINX_IRQ*
U5 74AC04
R21 150
R22 10K
R23 10K
R24 10K
R25 100K
R26 10K
R27 10K
C12 10 10V 20%
C13 .47 20%
C14 .47 20%
C15 .47 20%
+5V MINX +5.0
MINX RTN
-5V MINX -5.0
5V
PWRRTN
PWRBUS
OBF*
NC
U40 74HC245
U43 74HC541
U14 74AC32
ACK* J1-46 (B23)
STB* J1-50 (B25)
U39 10K
R6 10K
HD0-HD15
HD15
HD14
HD13
HD12
HD11
HD10
HD9
HD8
HD7
HD6
HD5
HD4
HD3
HD2
HD1
HD0
PA7
PA6
PA5
PA4
PA3
PA2
PA1
PA0
R/W*
MINX*
INT DET
CALIB OK
SPARE
LQS
NO PRB
PRB OFF
LO SAT
IBF
HOST_RDL*
HOST_RDH*
MINX_WR*
U38
U41
100
+5

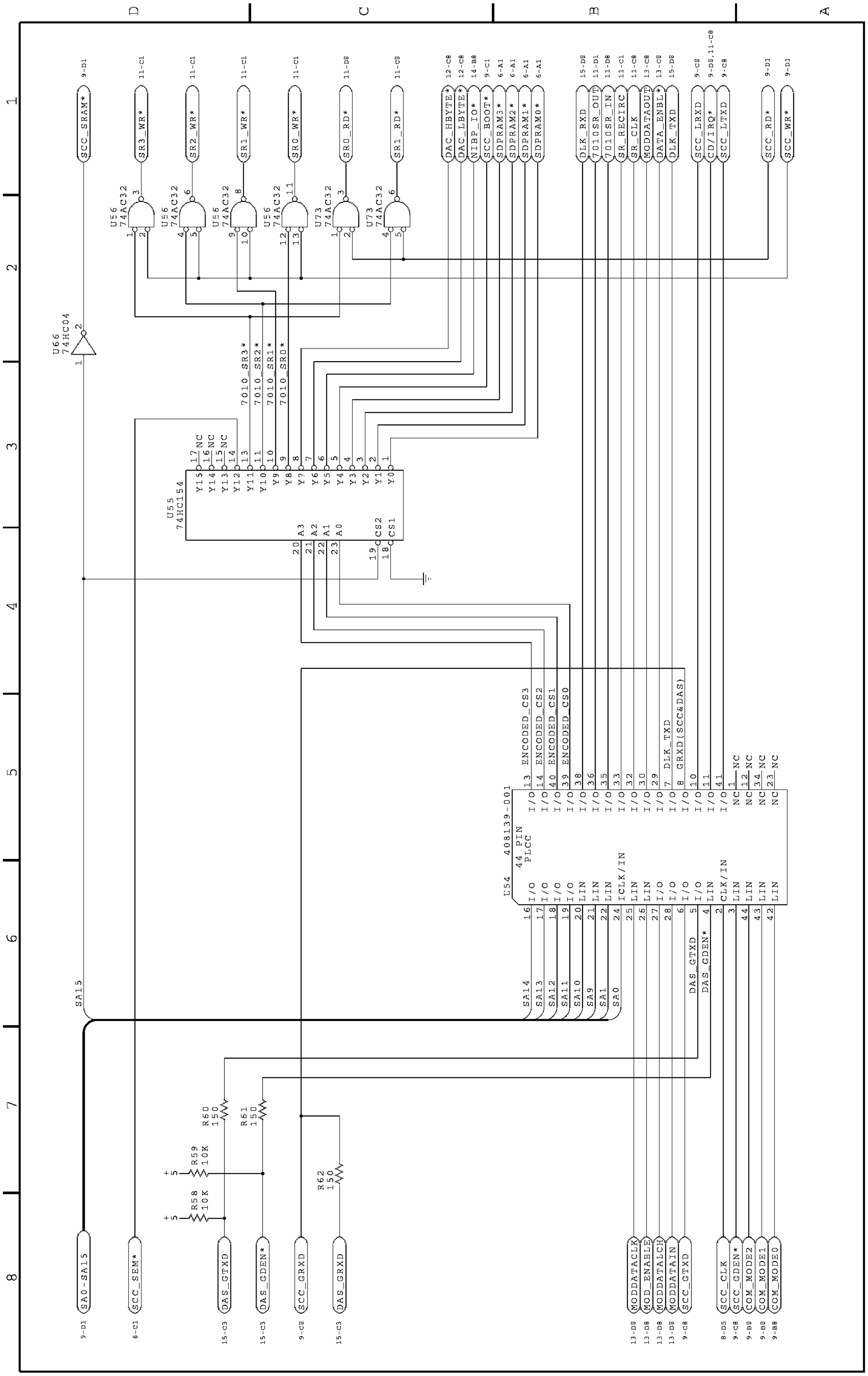
8 of 18


D
C
B
A
1
2
3
4
5
6
7
8
DSYNC_OUT 15-C8
CR3 P6SMB20A
C16 .22 20%
Q4 BCX56-10
R47 49.9
CR1 BAT54
NC
Q5 BCX56-10
R48 49.9
Q3 3904
Q6 3904
R45 3.4K
Q2 3904
R46 1.5K
R44 10K
Q1 3904
W1 5V 15V
+5
+15.5
R42 47.5K
R43 47.5K
DEFIB SYNC VOLTAGE SELECT
DSYNC_DRV 2-B1
SCC_CLK 9-A8,10-B8
MPU_CLK 1-C8
R36 100K
R34 100K
R35 49.9
R3 49.9
U46 74AC253
A B S1 S0 A0 A1 A2 A3 AOE B0 B1 B2 B3 BOE
R32 1K
R31 1K
R7 49.9
R29 100K
R30 1K
R72 49.9
U44 CLOCK OSC 14.7456MHz PLCC
R28 1K
U45 74HC74
PR Q D C CL
TMR_CLK 2-B1
MARKER_RTN 15-C8
MMBD7000
CR2
R53 10K
C17 .1
R52 10K
Q8 3904
R50 34.8K
R51 249
Q7 3904
R49 3.4K
U47 74HC541
A1 A2 A3 A4 A5 A6 A7 A8 Y1 Y2 Y3 Y4 Y5 Y6 Y7 Y8 G1 G2
HD8 HD9 HD10 HD11 HD12 HD13 HD14 HD15
R37 10K
R38 10K
R39 10K
R40 10K
R41 10K
W2 NOT INSTALLED
DEFIB SYNC PULSEWIDTH (W2 IN FOR 100mS)
S1 DPSW6
12 CLOSED=DISABLED
11 CLOSED=7.3728MHz
10 CLOSED TO DISABLE PROGRAM MEMORY UPDATE
9 CLOSED FOR INTEGRATED BATTERY
8 CLOSED FOR SI UNITS
7 CLOSED FOR 50Hz
68000 CLK DISABLE
68000 CLK FREQUENCY
RTC ADJUST/PGM UPDATE
BATTERY OPTION
ENGLISH/SI
60Hz/50Hz
MARKER_IN 1-B8
CFG/SEM* 1-D1
HOST_RDH* 1-B1
HD0-HD15 1-D8

9 of 18

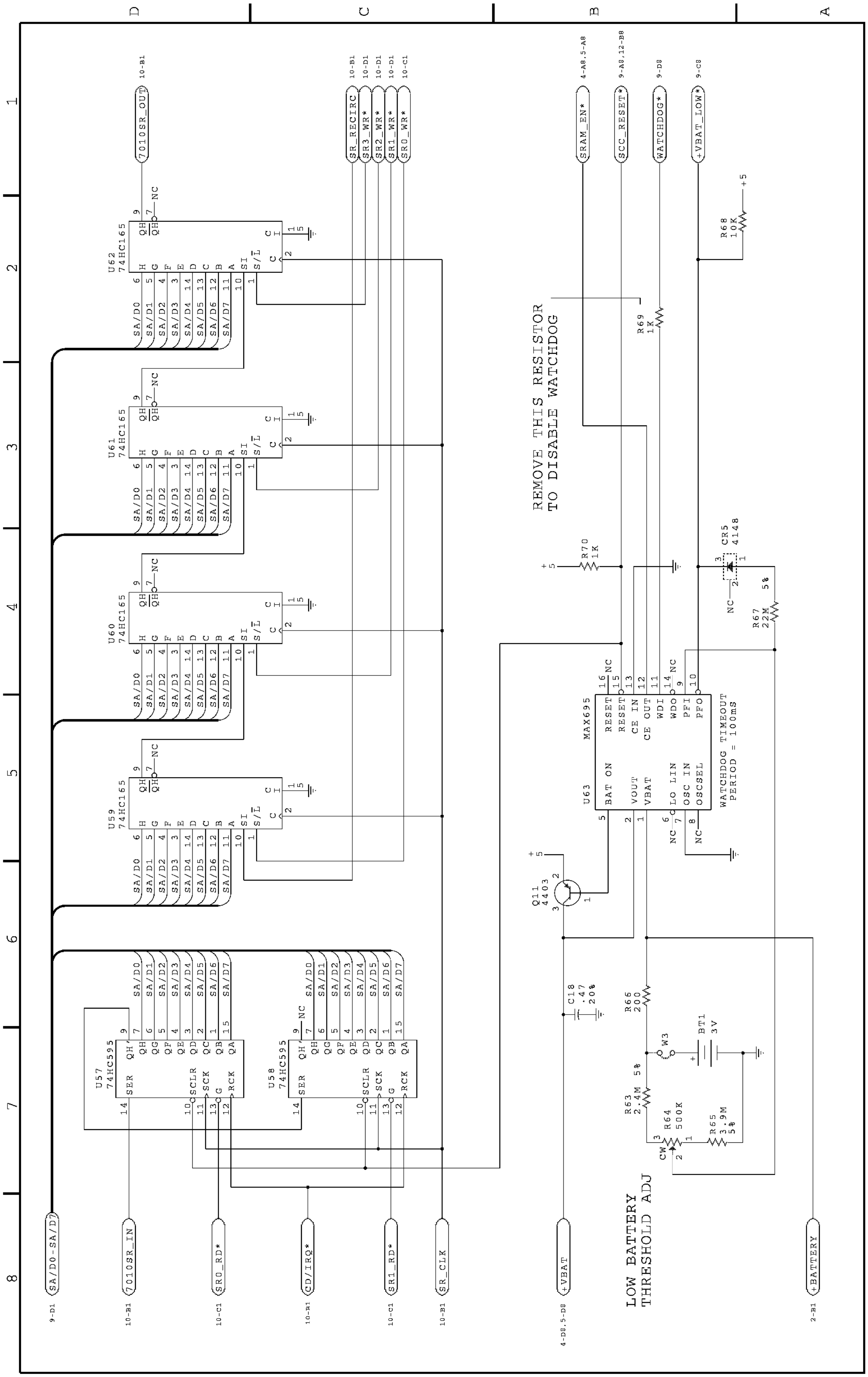

SAC-SA15
SA/D0-SA/D7
SCC_SRAM*
SCC_WR*
SCC_RD*
SCC_BOOT*
U51
HM62256
U52
404904-002
32 PIN PLCC
U53
10K
U49
74HC573
R57
1K
Q10
3904
Q9
3904
R55
34.8K
R56
34.8K
C97
.01
5%
R54
3.4K
+5
U50
74AC08
U48
80C152JB
68 PIN PLCC
BOOT*
MPU_ENBL*
MPU_RESET*
MPU_HALT*
CD/IRQ*
HOST_IRQ*
SCC_IRQ*
WATCHDOG*
MUX_ENBL*
SYNCPULSE*
+VBAT_LOW*
BKPLANE_ID
SCC_GDEN*
SCC_GTXD
SCC_GRXD
SCC_LTXD
SCC_LRXD
SDI
CLK
SDO
SER_CMD*
STROBE*
SHUTDOWN
BATT_NC2
BATT_NC1
CLR
BATT_ID*
DISPLAY_ON
RED/GREEN*
VPP_LOW*
COM_MODE2
COM_MODE1
COM_MODE0
FAN_ENBL*
DPRAM_MAP*
PGM_WE*
VPP_ENBL*
NIBP_ENBL*
MINX_ENBL*
DAS_ENBL*
SCC_CLK
SCC_RESET*
D
C
B
A
1
2
3
4
5
6
7
8

10 of 18

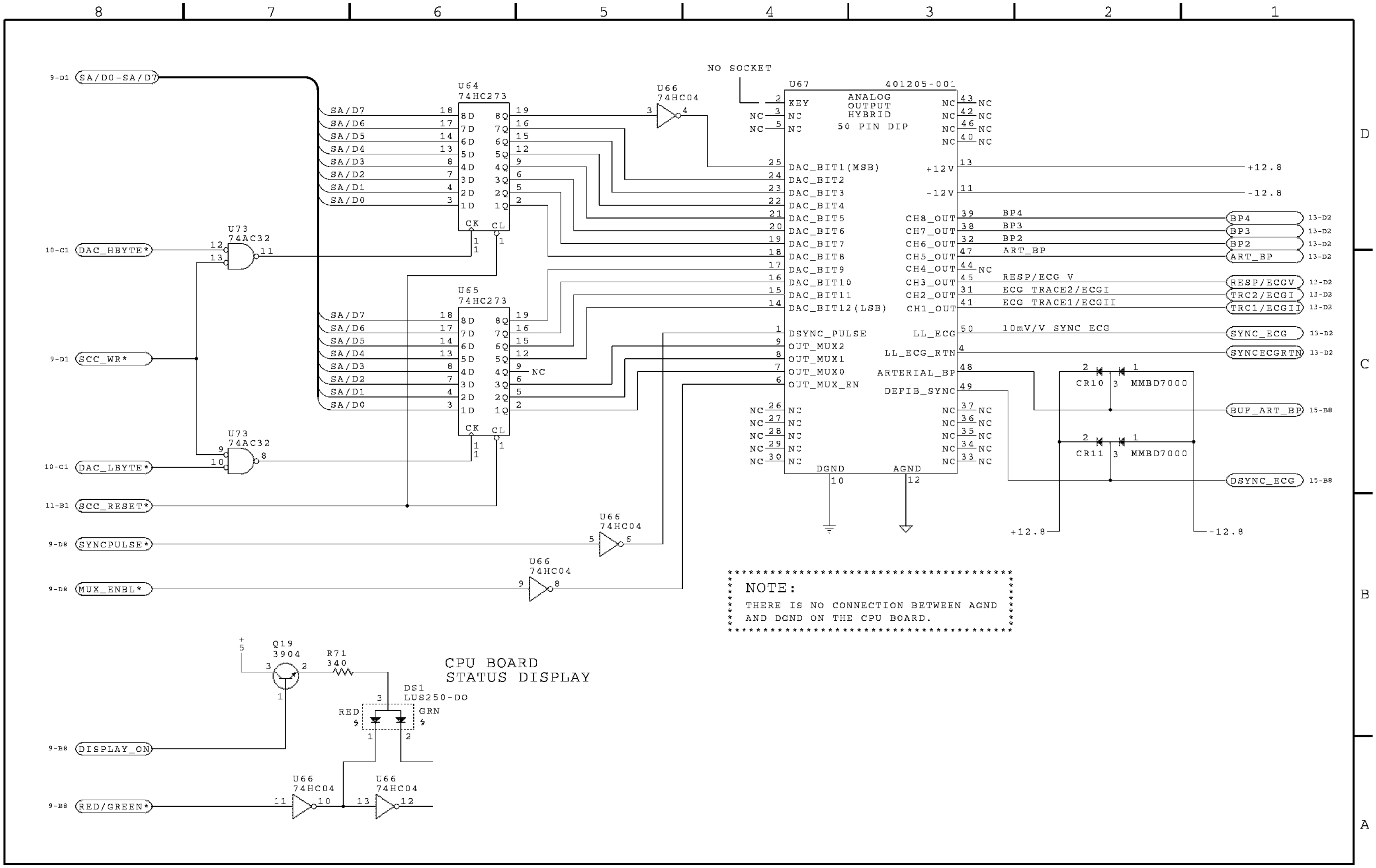


D
C
B
A
1
2
3
4
5
6
7
8
SCC_SRAM*
SR3_WR*
SR2_WR*
SR1_WR*
SR0_WR*
SR0_RD*
SR1_RD*
DAC_HBYTE*
DAC_LBYTE*
NIBP_IO*
SCC_BOOT*
SDPRAM3*
SDPRAM2*
SDPRAM1*
SDPRAM0*
DLK_RXD
7010SR_OUT
7010SR_IN
SR_RECIRC
SR_CLK
MODDATAOUT
DATA_ENBL*
DLK_TXD
SCC_LRXD
CD/IRQ*
SCC_LTXD
SCC_RD*
SCC_WR*
U56 74AC32
U73 74AC32
U66 74HC04
7010_SR3*
7010_SR2*
7010_SR1*
7010_SR0*
U55 74HC154
Y15
Y14
Y13
Y12
Y11
Y10
Y9
Y8
Y7
Y6
Y5
Y4
Y3
Y2
Y1
Y0
A3
A2
A1
A0
CS2
CS1
NC
ENCODED_CS3
ENCODED_CS2
ENCODED_CS1
ENCODED_CS0
DLK_TXD
GRXD(SCC&DAS)
U54 408139-001 44 PIN PLCC
I/O
LIN
ICLK/IN
CLK/IN
SA15
SA14
SA13
SA12
SA11
SA10
SA9
SA1
SA0
DAS_GTXD
DAS_GDEN*
R60 150
R61 150
R59 10K
R58 10K
R62 150
+5
SA0-SA15
SCC_SEM*
DAS_GTXD
DAS_GDEN*
SCC_GRXD
DAS_GRXD
MODDATACLK
MOD_ENABLE
MODDATALCH
MODDATAIN
SCC_GTXD
SCC_CLK
SCC_GDEN*
COM_MODE2
COM_MODE1
COM_MODE0
9-D1
11-C1
11-D8
11-C8
12-C8
14-B8
9-C1
6-A1
15-D8
11-D1
13-C8
9-C8
9-D8,11-C8
6-C1
15-C3
13-D8
8-D5
9-B8

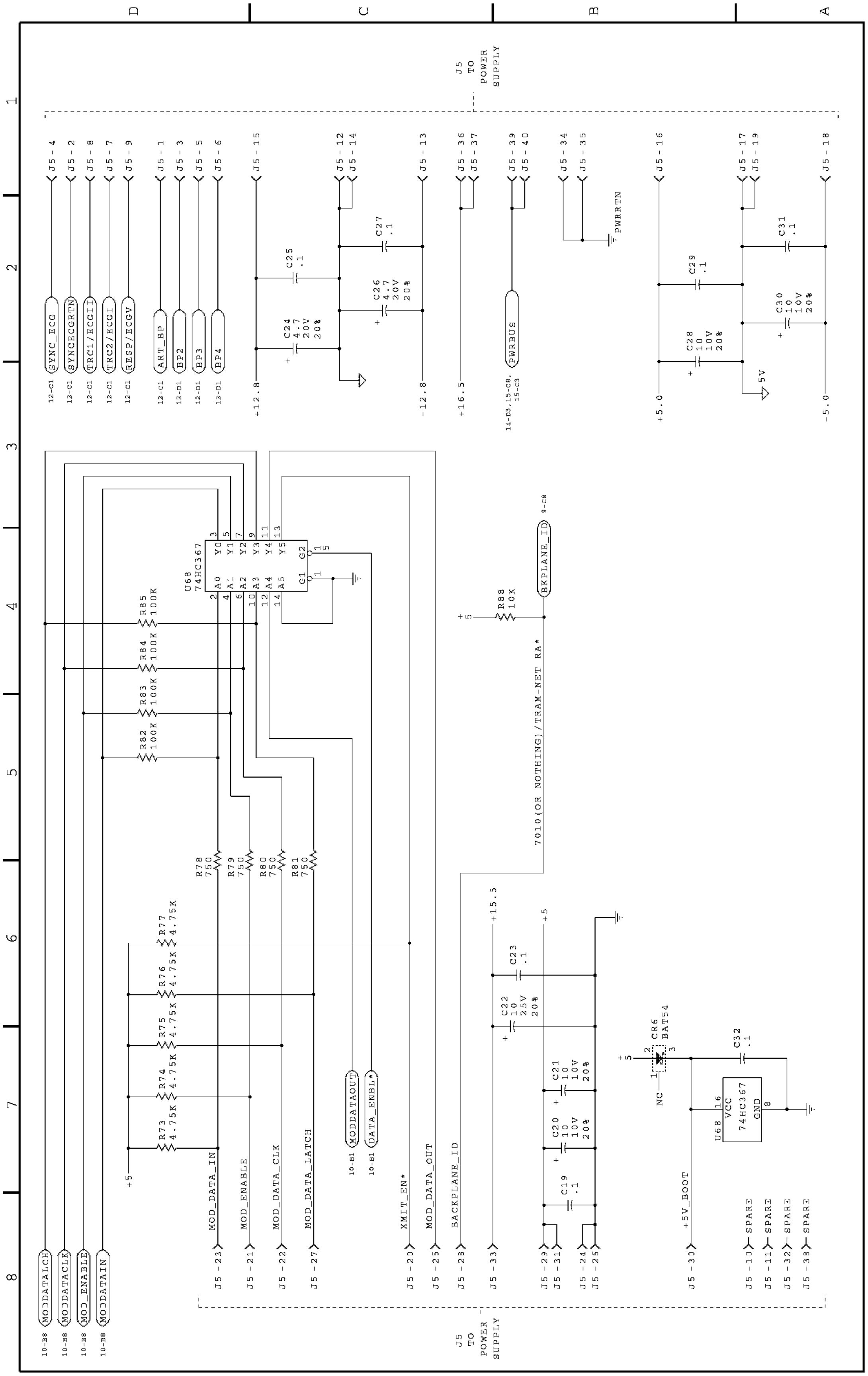
11 of 18


REMOVE THIS RESISTOR
TO DISABLE WATCHDOG
LOW BATTERY
THRESHOLD ADJ
WATCHDOG TIMEOUT
PERIOD = 100mS
U62 74HC165
U61 74HC165
U60 74HC165
U59 74HC165
U57 74HC595
U58 74HC595
U63 MAX695
Q11 4403
R68 10K
R69 1K
R70 1K
CR5 4148
R67 22M 5%
C18 .47 20%
R66 200
W3
BT1 3V
R63 2.4M 5%
R64 500K
R65 3.9M 5%
CW
NC
+5
7010SR_OUT 10-B1
SR_RECIRC 10-B1
SR3_WR* 10-D1
SR2_WR* 10-D1
SR1_WR* 10-D1
SR0_WR* 10-C1
SRAM_EN* 4-A8,5-A8
SCC_RESET* 9-A8,12-B8
WATCHDOG* 9-D8
+VBAT_LOW* 9-C8
SA/D0-SA/D7 9-D1
7010SR_IN 10-B1
SR0_RD* 10-C1
CD/IRQ* 10-B1
SR1_RD* 10-C1
SR_CLK 10-B1
+VBAT 4-D8,5-D8
+BATTERY 2-B1
SA/D0
SA/D1
SA/D2
SA/D3
SA/D4
SA/D5
SA/D6
SA/D7
H
G
F
E
D
C
B
A
SI
S/L
QH
CI
CK
SER
SCLR
SCK
RCK
QA
QB
QC
QD
QE
QF
QG
RESET
CE IN
CE OUT
WDI
WDO
PFI
PFO
BAT ON
VOUT
VBAT
LO LIN
OSC IN
OSCSEL
A
B
C
D
1
2
3
4
5
6
7
8

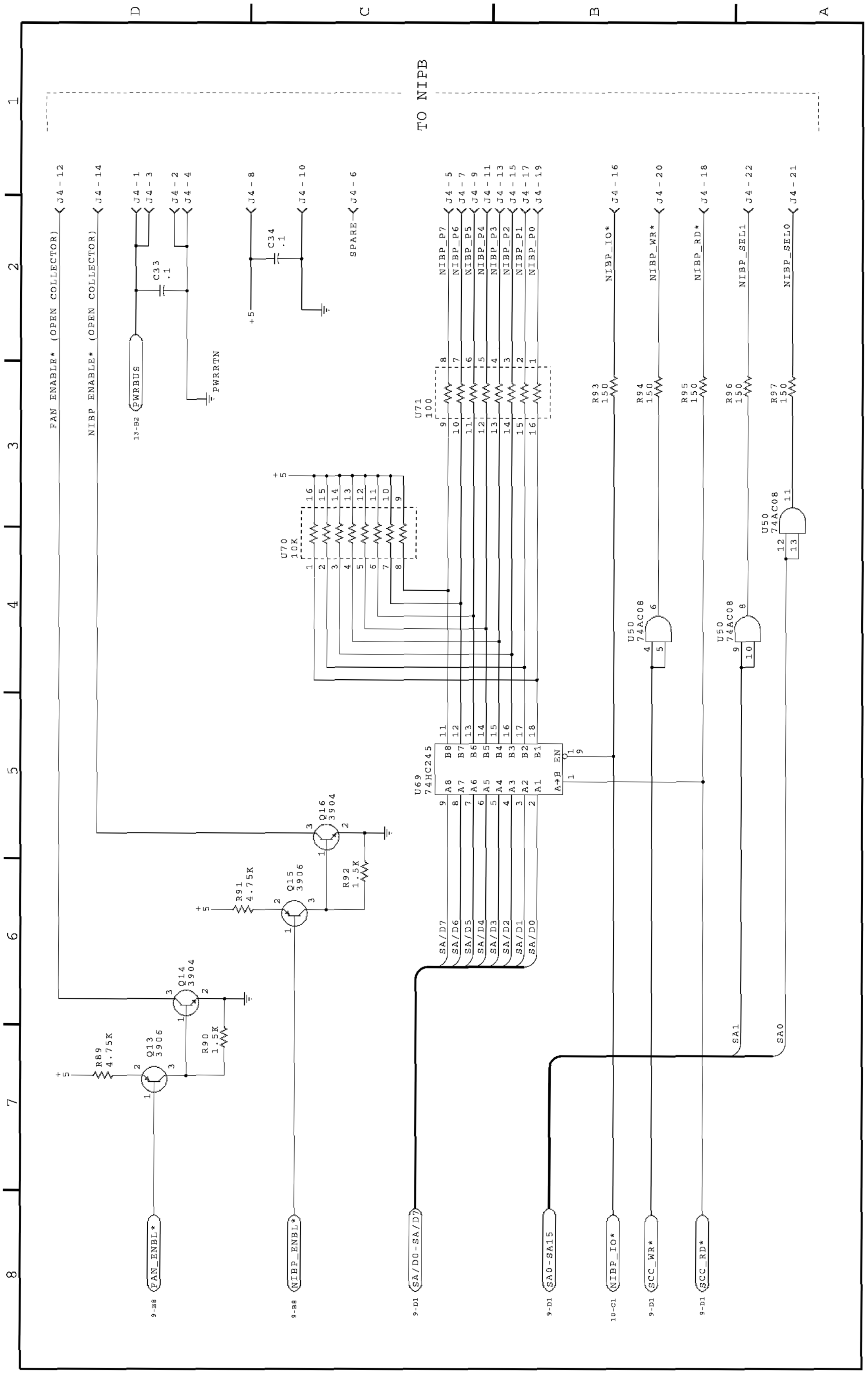
12 of 18


8
7
6
5
4
3
2
1
D
C
B
A
9-D1 SA/D0-SA/D7
10-C1 DAC_HBYTE*
9-D1 SCC_WR*
10-C1 DAC_LBYTE*
11-B1 SCC_RESET*
9-D8 SYNCPULSE*
9-D8 MUX_ENBL*
9-B8 DISPLAY_ON
9-B8 RED/GREEN*
U64
74HC273
U65
74HC273
SA/D7
SA/D6
SA/D5
SA/D4
SA/D3
SA/D2
SA/D1
SA/D0
8D 7D 6D 5D 4D 3D 2D 1D
8Q 7Q 6Q 5Q 4Q 3Q 2Q 1Q
CK
CL
U73
74AC32
U66
74HC04
NO SOCKET
U67
401205-001
ANALOG
OUTPUT
HYBRID
50 PIN DIP
KEY
NC
DAC_BIT1(MSB)
DAC_BIT2
DAC_BIT3
DAC_BIT4
DAC_BIT5
DAC_BIT6
DAC_BIT7
DAC_BIT8
DAC_BIT9
DAC_BIT10
DAC_BIT11
DAC_BIT12(LSB)
DSYNC_PULSE
OUT_MUX2
OUT_MUX1
OUT_MUX0
OUT_MUX_EN
DGND
AGND
+12V
-12V
CH8_OUT
CH7_OUT
CH6_OUT
CH5_OUT
CH4_OUT
CH3_OUT
CH2_OUT
CH1_OUT
LL_ECG
LL_ECG_RTN
ARTERIAL_BP
DEFIB_SYNC
+12.8
-12.8
BP4
BP3
BP2
ART_BP
RESP/ECG V
ECG TRACE2/ECGI
ECG TRACE1/ECGII
10mV/V SYNC ECG
13-D2 BP4
13-D2 BP3
13-D2 BP2
13-D2 ART_BP
13-D2 RESP/ECGV
13-D2 TRC2/ECGI
13-D2 TRC1/ECGII
13-D2 SYNC_ECG
13-D2 SYNCECGRTN
15-B8 BUF_ART_BP
15-B8 DSYNC_ECG
CR10
CR11
MMBD7000
Q19
3904
R71
340
DS1
LUS250-DO
RED
GRN
CPU BOARD
STATUS DISPLAY
+5
NOTE:
THERE IS NO CONNECTION BETWEEN AGND
AND DGND ON THE CPU BOARD.

13 of 18

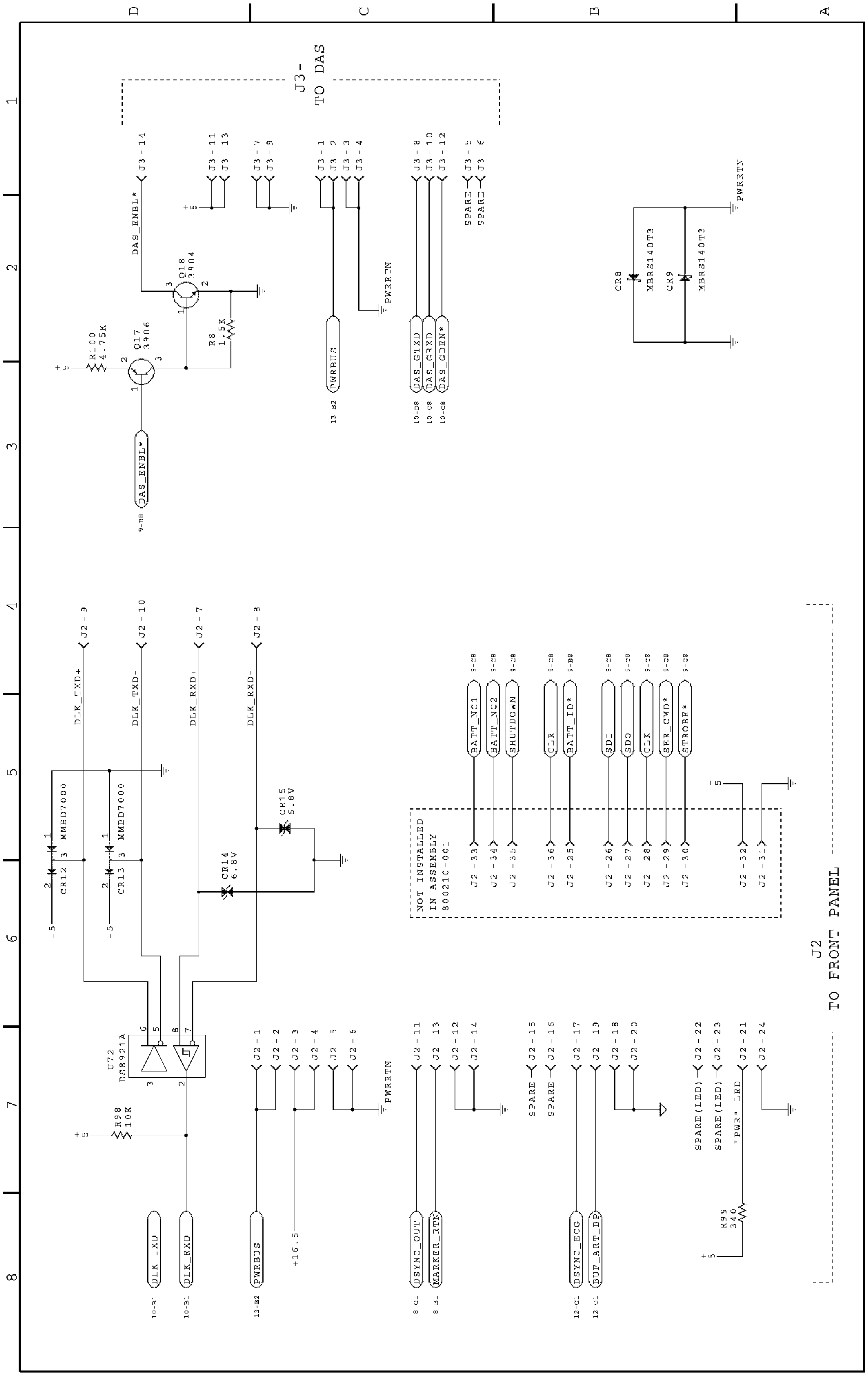

J5 TO POWER SUPPLY
SYNC_ECG
SYNCECGRTN
TRC1/ECGII
TRC2/ECGI
RESP/ECGV
ART_BP
BP2
BP3
BP4
PWRBUS
PWRRTN
C24 4.7 20V 20%
C25 .1
C26 4.7 20V 20%
C27 .1
C28 10 10V 20%
C29 .1
C30 10 10V 20%
C31 .1
+12.8
-12.8
+16.5
+5.0
-5.0
5V
U68 74HC367
BKPLANE_ID
R88 10K
7010(OR NOTHING)/TRAM-NET RA*
R82 100K
R83 100K
R84 100K
R85 100K
R78 750
R79 750
R80 750
R81 750
R73 4.75K
R74 4.75K
R75 4.75K
R76 4.75K
R77 4.75K
MODDATAOUT
DATA_ENBL*
MOD_DATA_IN
MOD_ENABLE
MOD_DATA_CLK
MOD_DATA_LATCH
XMIT_EN*
MOD_DATA_OUT
BACKPLANE_ID
+15.5
C19 .1
C20 10 10V 20%
C21 10 10V 20%
C22 10 25V 20%
C23 .1
CR6 BAT54
NC
C32 .1
U68 VCC 74HC367 GND
+5V_BOOT
SPARE
MODDATALCH
MODDATACLK
MOD_ENABLE
MODDATAIN
J5 TO POWER SUPPLY

14 of 18

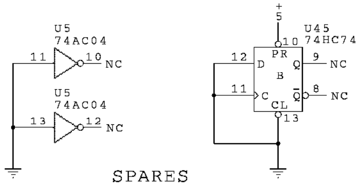


D
C
B
A
1
2
3
4
5
6
7
8
TO NIPB
J4-12
J4-14
J4-1
J4-3
J4-2
J4-4
J4-8
J4-10
J4-6
J4-5
J4-7
J4-9
J4-11
J4-13
J4-15
J4-17
J4-19
J4-16
J4-20
J4-18
J4-22
J4-21
FAN ENABLE* (OPEN COLLECTOR)
NIBP ENABLE* (OPEN COLLECTOR)
C33
.1
C34
.1
+5
SPARE
PWRBUS
13-B2
PWRRTN
NIBP_P7
NIBP_P6
NIBP_P5
NIBP_P4
NIBP_P3
NIBP_P2
NIBP_P1
NIBP_P0
NIBP_IO*
NIBP_WR*
NIBP_RD*
NIBP_SEL1
NIBP_SEL0
U71
100
R93
150
R94
150
R95
150
R96
150
R97
150
U70
10K
U50
74AC08
U69
74HC245
A→B
EN
Q16
3904
Q15
3906
Q14
3904
Q13
3906
R91
4.75K
R92
1.5K
R89
4.75K
R90
1.5K
SA/D7
SA/D6
SA/D5
SA/D4
SA/D3
SA/D2
SA/D1
SA/D0
SA1
SA0
FAN_ENBL*
NIBP_ENBL*
SA/D0-SA/D7
SA0-SA15
NIBP_IO*
SCC_WR*
SCC_RD*
9-B8
9-B8
9-D1
9-D1
10-C1
9-D1
9-D1

15 of 18


J3- TO DAS
J2 TO FRONT PANEL
NOT INSTALLED IN ASSEMBLY 800210-001
DAS_ENBL*
Q17 3906
Q18 3904
R100 4.75K
R8 1.5K
PWRBUS
PWRRTN
DAS_GTXD
DAS_GRXD
DAS_GDEN*
SPARE
CR8 MBRS140T3
CR9 MBRS140T3
DLK_TXD+
DLK_TXD-
DLK_RXD+
DLK_RXD-
CR12 MMBD7000
CR13 MMBD7000
CR14 6.8V
CR15 6.8V
U72 DS8921A
R98 10K
DLK_TXD
DLK_RXD
+16.5
DSYNC_OUT
MARKER_RTN
DSYNC_ECG
BUP_ART_BP
BATT_NC1
BATT_NC2
SHUTDOWN
CLR
BATT_ID*
SDI
SDO
CLK
SER_CMD*
STROBE*
SPARE(LED)
"PWR" LED
R99 340
+5

IC POWER/RETURN CHART						POWER SUPPLY				
IC		POWER		RETURN		BYPASS				
U1	74HC541	20	+5	10		C35	.1			
U2	5AC312	1,28	+5	14,15		C36	.1	C37	.1	
U3	68HC000	14&52	+5	16,17,56,57		C38	.47 20%	C39	.47 20%	
U4	5AC324	15,37	+5	9,31		C40	.22 20%	C41	.22 20%	
U5	74AC04	14	+5	7		C42	.1			
U6	74AC32	14	+5	7		C43	.1			
U8	74ACQ245	20	+5	10		C44	.22 20%			
U9	74ACQ245	20	+5	10		C45	.22 20%			
U13	DP8570	28	+5	14		C46	.1			
U14	74AC32	14	+5	7		C47	.1			
U16	28F020	32	+5	16		C48	.1			
U17	28F020	32	+5	16		C49	.1			
U18	28F020	32	+5	16		C50	.1	NOT INSTALLED		
U19	28F020	32	+5	16		C51	.1	NOT INSTALLED		
U20	628128L	32	+VBAT	16		C52	.1	NOT INSTALLED		
U21	628128L	32	+VBAT	16		C53	.1	NOT INSTALLED		
U22	628128L	32	+VBAT	16		C54	.1	NOT INSTALLED		
U23	628128L	32	+VBAT	16		C55	.1	NOT INSTALLED		
U24	628128L	32	+VBAT	16		C56	.1	NOT INSTALLED		
U25	628128L	32	+VBAT	16		C57	.1	NOT INSTALLED		
U26	74AC32	14	+VBAT	7		C58	.1	NOT INSTALLED		
U27	628128L	32	+VBAT	16		C59	.1	NOT INSTALLED		
U28	628128L	32	+VBAT	16		C60	.1	NOT INSTALLED		
U29	628128L	32	+VBAT	16		C61	.1			
U30	628128L	32	+VBAT	16		C62	.1			
U31	628128L	32	+VBAT	16		C63	.1			
U32	628128L	32	+VBAT	16		C64	.1			
U33	74AC32	14	+VBAT	7		C65	.1			
U34	7134LA	52	+5	26		C66	.22 20%	NOT INSTALLED		
U35	7134LA	52	+5	26		C67	.22 20%	NOT INSTALLED		
U36	7134LA	52	+5	26		C68	.22 20%			
U37	71342LA SEMAPHORE RAM	52	+5	26	GND	C69	.22 20%			
U40	74HC245	20	+5	10		C70	.22 20%			
U43	74HC541	20	+5	10		C71	.22 20%			
U44	CLK OSC 14.7456MHz	4	+5	2	GND	C72	.1	C100	.001 5%	
U45	74HC74	14	+5	7		C73	.1	C102	.001 5%	
U46	74AC253	16	+5	8		C74	.1	C101	.001 5%	
U47	74HC541	20	+5	10		C75	.22 20%			
U48	80C152JB -1	2	+5	3,33	GND	C76	.47 20%			
U49	74HC573	20	+5	10		C77	.22 20%			
U50	74AC08	14	+5	7		C78	.1			
U51	HM62256 -120 OR -150	28	+5	14	GND	C79	.1			
U52	27C256 -150ns	32	+5	16	GND	C80	.1			
U54	5AC324	15,37	+5	9,31		C81	.22 20%	C82	.22 20%	
U55	74HC154	24	+5	12		C83	.1			
U56	74AC32	14	+5	7		C84	.1			
U57	74HC595	16	+5	8		C85	.1			
U58	74HC595	16	+5	8		C86	.1			
U59	74HC165	16	+5	8		C87	.1			
U60	74HC165	16	+5	8		C88	.1			
U61	74HC165	16	+5	8		C89	.1			
U62	74HC165	16	+5	8		C90	.1			
U63	MAX695	3	+5	4		C91	.1			
U64	74HC273	20	+5	10		C92	.1			
U65	74HC273	20	+5	10		C93	.1			
U66	74HC04	14	+5	7		C94	.1			
U69	74HC245	20	+5	10		C95	.22 20%			
U72	DS8921A	1	+5	4		C96	.1			
U73	74AC32	14	+5	7		C98	.1			



17 of 18

REFDES	PAGE COORDINATES
U1:	1-D7
U10:	2-D4
U11:	2-C4
U12:	2-D2
U13:	2-B4
U14:	3-D7 7-A4,A5
U15:	3-D3
U16:	3-C6
U17:	3-B6
U18:	3-C3
U19:	3-B3
U2:	1-B7
U20:	4-D6
U21:	4-C6
U22:	4-D4
U23:	4-C4
U24:	4-D2
U25:	4-C2
U26:	4-B8
U27:	5-D6
U28:	5-C6
U29:	5-D4
U3:	1-D5
U30:	5-C4
U31:	5-D2
U32:	5-C2
U33:	5-B8
U34:	6-D7
U35:	6-B7
U36:	6-D3
U37:	6-C3
U38:	7-B7,C7,D7
U39:	7-C6
U4:	1-D3
U40:	7-D4
U41:	7-B7,C7,D7
U43:	7-B4
U44:	8-D8
U45:	8-D8
U46:	8-D7
U47:	8-B5
U48:	9-D7
U49:	9-B4
U5:	1-B3,D2 7-C2,D2
U50:	9-C5 14-A4,B4
U51:	9-D3
U52:	9-C3
U53:	9-B3
U54:	10-B6
U55:	10-D4
U56:	10-C2,D2
U57:	11-D7
U58:	11-C7
U59:	11-D5
U6:	1-B2
U60:	11-D4
U61:	11-D3
U62:	11-D2
U63:	11-B5
U64:	12-D6
U65:	12-C6
U66:	10-D3 12-A6,A7,B5,B6,D5
U67:	12-D4
U68:	13-B7,D4
U69:	14-C5
U7:	2-D7
U70:	14-C4
U71:	14-C3
U72:	15-D7
U73:	10-C2 12-C7,D7
U8:	2-C7
U9:	2-B7

REFDES PAGE COORDINATES

REFDES PAGE COORDINATES

CONN	LABEL
J1-12:	GND
J1-17:	PWRRTN
J1-18:	PWRBUS
J1-19:	PWRRTN
J1-20:	PWRBUS
J1-22:	GND
J1-24:	GND
J1-26:	GND
J1-27:	07081019
J1-28:	07011007
J1-29:	07081020
J1-30:	07011010
J1-31:	GND
J1-32:	07011012
J1-33:	GND
J1-34:	07011015
J1-35:	07081023
J1-36:	07011017
J1-37:	GND
J1-38:	07011020
J1-39:	GND
J1-4:	GND
J1-40:	07011022
J1-41:	07081026
J1-42:	07011025
J1-43:	07081027
J1-44:	MINX_IRQ*
J1-45:	07011036
J1-46:	07062061
J1-47:	07011038
J1-48:	07011053
J1-49:	07011041
J1-50:	07057065
J1-51:	07011043
J1-53:	07011046
J1-54:	07081044
J1-55:	07011048
J1-57:	07011051
J1-58:	+5.0
J1-59:	5VAGND
J1-6:	GND
J1-60:	-5.0
J1-61:	+5
J1-62:	+5
J1-63:	GND
J1-64:	GND
J1-8:	GND

CONN	LABEL
J2-1:	PWRBUS
J2-10:	15029013
J2-11:	DSYNC_OUT
J2-12:	GND
J2-13:	MARKER_RTN
J2-14:	GND
J2-17:	DSYNC_ECG
J2-18:	AGND
J2-19:	BUF_ART_BP
J2-2:	PWRBUS
J2-20:	AGND
J2-21:	15016058
J2-24:	GND
J2-25:	BATT_ID*
J2-26:	SDI
J2-27:	SDO
J2-28:	CLK
J2-29:	SER_CMD*
J2-3:	+16.5
J2-30:	STROBE*
J2-31:	GND
J2-32:	+5
J2-33:	BATT_NC1
J2-34:	BATT_NC2
J2-35:	SHUTDOWN
J2-36:	CLR
J2-4:	+16.5
J2-5:	PWRRTN
J2-6:	PWRRTN
J2-7:	15029014
J2-8:	15029015
J2-9:	15029012
J3-1:	PWRBUS
J3-10:	DAS_GRXD
J3-11:	+5
J3-12:	DAS_GDEN*
J3-13:	+5
J3-14:	15086011
J3-2:	PWRBUS
J3-3:	PWRRTN
J3-4:	PWRRTN
J3-7:	GND
J3-8:	DAS_GTXD
J3-9:	GND

CONN	LABEL
J4-1:	PWRBUS
J4-10:	GND
J4-11:	14082038
J4-12:	14031005
J4-13:	14082039
J4-14:	14044008
J4-15:	14082040
J4-16:	14080048
J4-17:	14082041
J4-18:	14080055
J4-19:	14082042
J4-2:	PWRRTN
J4-20:	14080052
J4-21:	14080062
J4-22:	14080059
J4-3:	PWRBUS
J4-4:	PWRRTN
J4-5:	14082035
J4-7:	14082036
J4-8:	+5
J4-9:	14082037
J5-1:	ART_BP
J5-12:	AGND
J5-13:	-12.8
J5-14:	AGND
J5-15:	+12.8
J5-16:	+5.0
J5-17:	5VAGND
J5-18:	-5.0
J5-19:	5VAGND
J5-2:	SYNCECGRTN
J5-20:	13009032
J5-21:	13009020
J5-22:	13009022
J5-23:	13009017
J5-24:	GND
J5-25:	13009034
J5-26:	GND
J5-27:	13009025
J5-28:	BKPLANE_ID
J5-29:	+5
J5-3:	BP2
J5-30:	13009054
J5-31:	+5
J5-33:	+15.5
J5-34:	PWRRTN
J5-35:	PWRRTN
J5-36:	+16.5
J5-37:	+16.5
J5-39:	PWRBUS
J5-4:	SYNC_ECG
J5-40:	PWRBUS
J5-5:	BP3
J5-6:	BP4
J5-7:	TRC2/ECGI
J5-8:	TRC1/ECGII
J5-9:	RESP/ECGV

28

NBP PCB

PN 800316

General 28-2

Parts Location Diagram PN 800316-002A 28-3

Parts List PN 800316-002A 28-5

Schematic Diagram PN SD800316-002A 28-7

Parts Location Diagram PN 800316-001C 28-9

Parts List PN 800316-001C 28-10

Schematic Diagram PN SD800316-001C 28-12

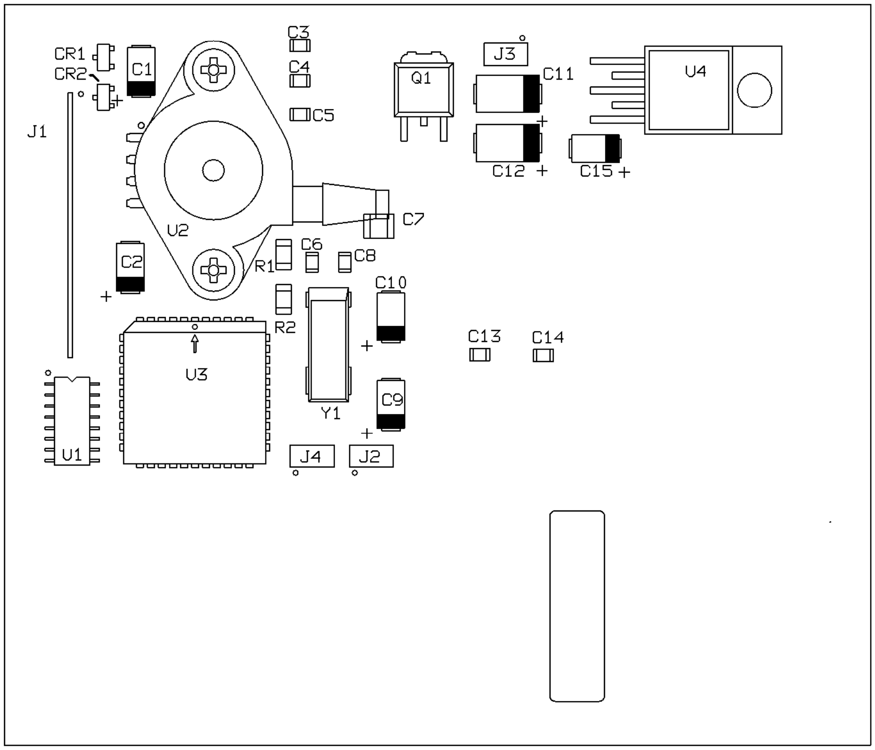
General

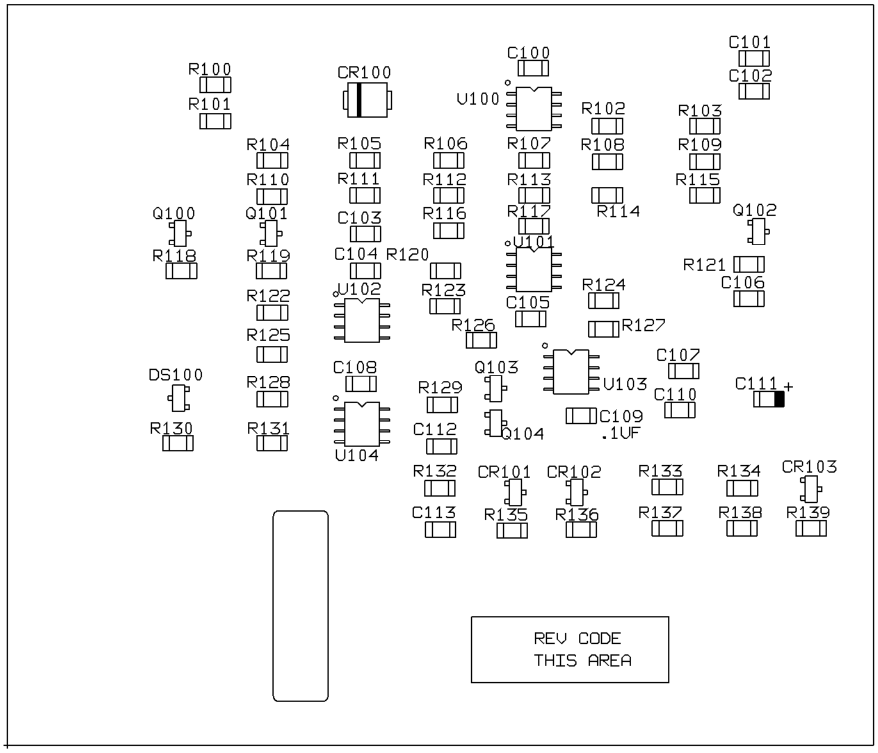
There are two different versions of the NBP PCB:

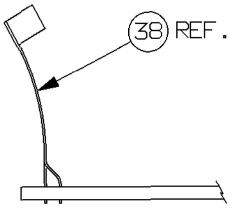
- pn 800316-001, was used first in all modules; and
- pn 800210-002, replaced the first version of the PCB.

NOTE
You may replace version -001 or -002 circuit board with a -002 circuit board, but do not replace a -002 with a -001 circuit board.

Parts Location Diagram PN 800316-002A

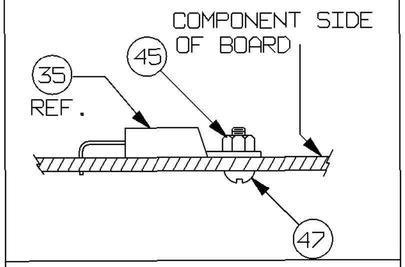

C3
CR1
C1
CR2
C4
C5
Q1
J3
C11
U4
J1
C12
C15
U2
C7
C6
C8
R1
C2
C10
R2
C13
C14
U3
Y1
C9
U1
J4
J2


C101
C100
R100
CR100
C102
U100
R101
R102
R103
R104
R105
R106
R107
R108
R109
R110
R111
R112
R113
R115
Q100
Q101
C103
R116
R117
R114
Q102
R118
R119
C104
R120
U101
R121
R122
U102
R123
R124
C106
C105
R125
R126
R127
DS100
C108
Q103
C107
R128
R129
U103
C111
C110
R130
R131
C112
C109
.1UF
Q104
U104
R132
CR101
CR102
R133
R134
CR103
C113
R135
R136
R137
R138
R139
REV CODE
THIS AREA



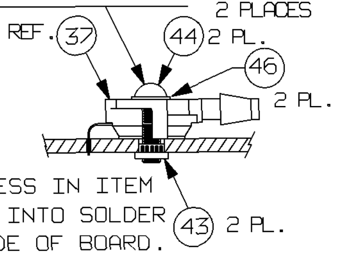
MOUNT ITEM 38 TO COMPONENT SIDE OF BOARD AS SHOWN.

DETAIL A


COMPONENT SIDE OF BOARD
45
35 REF.
47

DETAIL B

CRITICAL TORQUE: 1.5 IN. LBS. 2 PLACES


REF. 37
44 2 PL.
46
2 PL.
43 2 PL.

PRESS IN ITEM 43 INTO SOLDER SIDE OF BOARD.

DETAIL C

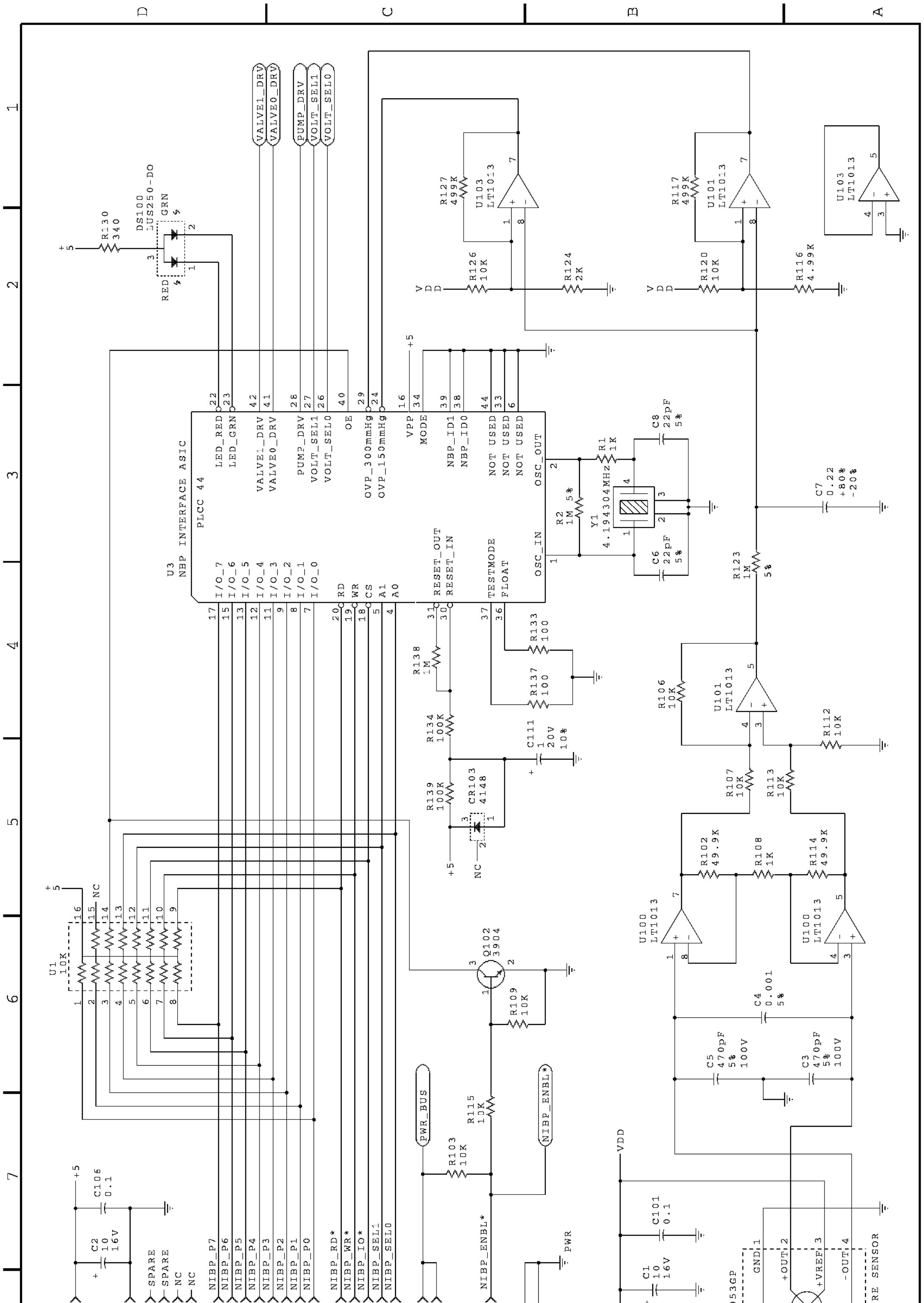
Parts List PN 800316-002A

Item	Parts List	Part Number	Qty
C1, 2	Cap, Tant, 1µF, 20%, 10V, SM	1176-106	2
C3, 5	Cap, Cer, 470pF, 5%, 50V, SM	1181-471	2
C4	Cap, Cer, 0.001µF, 5%, 50V, SM	1181-102	1
C6, 8	Cap, Cer, 22pF, 5%, 50V, SM	1181-220	2
C7	Cap, Cer, 0.22µF, 20%, 50V, SM	1187-224	1
C9, 10, 15	Cap, Tant, 4.7µF, 20%, 20V, SM	402004-001	3
C11, 12	Cap, Tant, 22µF, 10%, 25V, SM	407653-001	2
C13, 14	Cap, Cer, 0.01µF, 5%, 50V, SM	1182-103	2
C100-110, 112, 113	Cap, Cer, 0.1µF, 20%, 50V	404370-001	13
C111	Cap, Tant, 1µF, 10%, 16V, SM	403253-001	1
CR1, 2	Diode, Schottky, SM BAT54	401985-001	2
CR100	Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3	403187-001	1
CR101-103	Diode, SM MMAD4148	401980-001	3
DS1	Diode, Light-Emitting (Red/Green) LDGR 2340	402428-001	1
J1	Flex Circuit Assembly, NBP	404744-001	1
J2, 3, 4	PC Post	1778-604	6
Q1	Transistor, MOSFET, N-Channel, SM 25N05	407659-001	1
Q100-104	Transistor, NPN, SM T3904	2511-001	5
R1, 108, 111, 135, 136	Res, Cer, 1K, 1%, 1/8W, SM	1082-103	5
R2, 123	Res, Cer, 1M, 5%, 1/8W, SM	1081-105	2
R3	Res, Cer, 2.74K, 1%, 1/8W, SM	1082-823	1
R4	Res, Cer, 3.01K, 1%, 1/8W, SM	1082-821	1
R100	Res, 340Ω, 1%, 1/8W, SM	1082-790	1
R102, 114	Res, Cer, 49.9K, 1%, 1/8W, SM	1082-498	2
R103, 104, 106, 107, 109, 112, 113, 115, 118-120, 126	Res, Cer, 10K, 1%, 1/8W, SM	1082-104	12
R105, 121	Res, Cer, 10Ω, 1%, 1/8W, SM	1082-786	2
R110	Res, Cer, 6.34K, 1%, 1/8W, SM	1082-822	1
R116	Res, Cer, 4.99K, 10%, 1/4W, SM	1082-101	1
R117, 127	Res, Cer, 499K, 1%, 1/8W, SM	1082-499	2
R122, 128, 134, 139	Res, Cer, 100K, 1%, 1/8W, SM	1082-100	4
R124	Res, Cer, 2.00K, 10%, 1/4W, SM	1082-201	1
R125, 131	Res, Cer, 11.5K, 1%, 1/8W, SM	1082-815	2
R129, 132	Res, Cer, 51.1Ω, 10%, 1/4W, SM	1082-789	2
R133, 137	Res, Cer, 100Ω, 1%, 1/8W, SM	1082-755	2
R138	Res, Cer, 1M, 1%, 1/8W, SM	1082-828	1
U1	Res Ntwk, 10K	1061-103	1
U2	Sensor, Pressure, 7.3PSI, Compensated	404406-004	1
U3	FPGA, Programmed, NBP, PLCC	414521-001	1
U4	Volt Rgltr, Adj, TO220 LM2941CT	403609-001	1

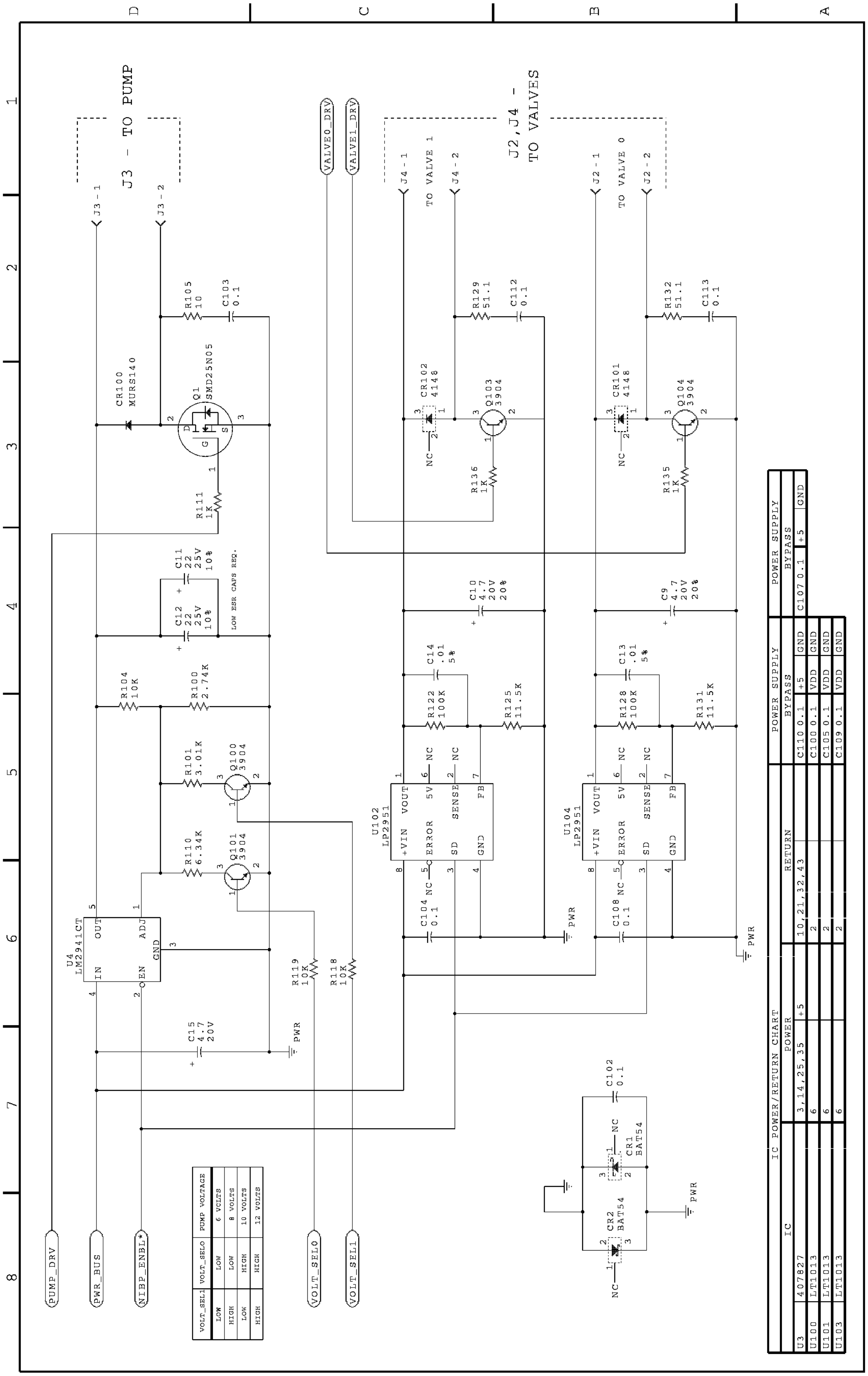
Item	Parts List	Part Number	Qty
U102, 104	Volt Rgltr, Adj, SM LP2951A	3076-001	2
U100-103	Operation Ampl, SM LT1013	3137-013	3
Y1	Crystal, 4.194304MHz, SM	407658-001	1
-	Insert, Threaded, 4-40	404158-001	2
-	Nut, ESNA, 4-40	4521-304	1
-	Screw, PNH, Phillips, 4-40 x 5/16 (for U4)	4502-410	1
-	Screw, PNH, Phillips, 4-40 x 1/2 (for U2)	45000-408	2
-	Washer, Flat, SST, No 4 (for U2, 4)	4520-004	2
-	Circuit Board	800317-002A	1
-	Schematic Diagram	SD800316-002A	-

Schematic Diagram PN SD800316-002A

1 of 2


D
C
B
A
1
2
3
4
5
6
7
8
U3
NBP INTERFACE ASIC
PLCC 44
LED_RED
LED_GRN
VALVE1_DRV
VALVE0_DRV
PUMP_DRV
VOLT_SEL1
VOLT_SEL0
OE
OVP_300mmHg
OVP_150mmHg
VPP
MODE
NBP_ID1
NBP_ID0
NOT USED
OSC_OUT
OSC_IN
I/O_7
I/O_6
I/O_5
I/O_4
I/O_3
I/O_2
I/O_1
I/O_0
RD
WR
CS
A1
A0
RESET_OUT
RESET_IN
TESTMODE
FLOAT
DS100
LUS250-DO
GRN
RED
R130
340
+5
R127
499K
U103
LT1013
R126
10K
R124
2K
VDD
R117
499K
U101
LT1013
R120
10K
R116
4.99K
R1
1K
C8
22pF
5%
R2
1M 5%
Y1
4.194304MHz
C6
22pF
5%
C7
0.22
+80%
-20%
R123
1M
5%
R133
100
R137
100
R138
1M
R134
100K
C111
1
20V
10%
R139
100K
CR103
4148
NC
R106
10K
R112
10K
R107
10K
R113
10K
R102
49.9K
R108
1K
R114
49.9K
U100
LT1013
U1
10K
Q102
3904
R109
10K
C4
0.001
5%
C5
470pF
5%
100V
C3
470pF
5%
100V
PWR_BUS
R115
1.3K
NIBP_ENBL*
R103
10K
C106
0.1
C2
10
16V
SPARE
NIBP_P7
NIBP_P6
NIBP_P5
NIBP_P4
NIBP_P3
NIBP_P2
NIBP_P1
NIBP_P0
NIBP_RD*
NIBP_WR*
NIBP_IO*
NIBP_SEL1
NIBP_SEL0
PWR
J1 - TO FAN BOARD
C101
0.1
C1
10
16V
R121
10
U2
SPX4053GP
GND
+OUT
+VREF
-OUT
PRESSURE SENSOR

2 of 2

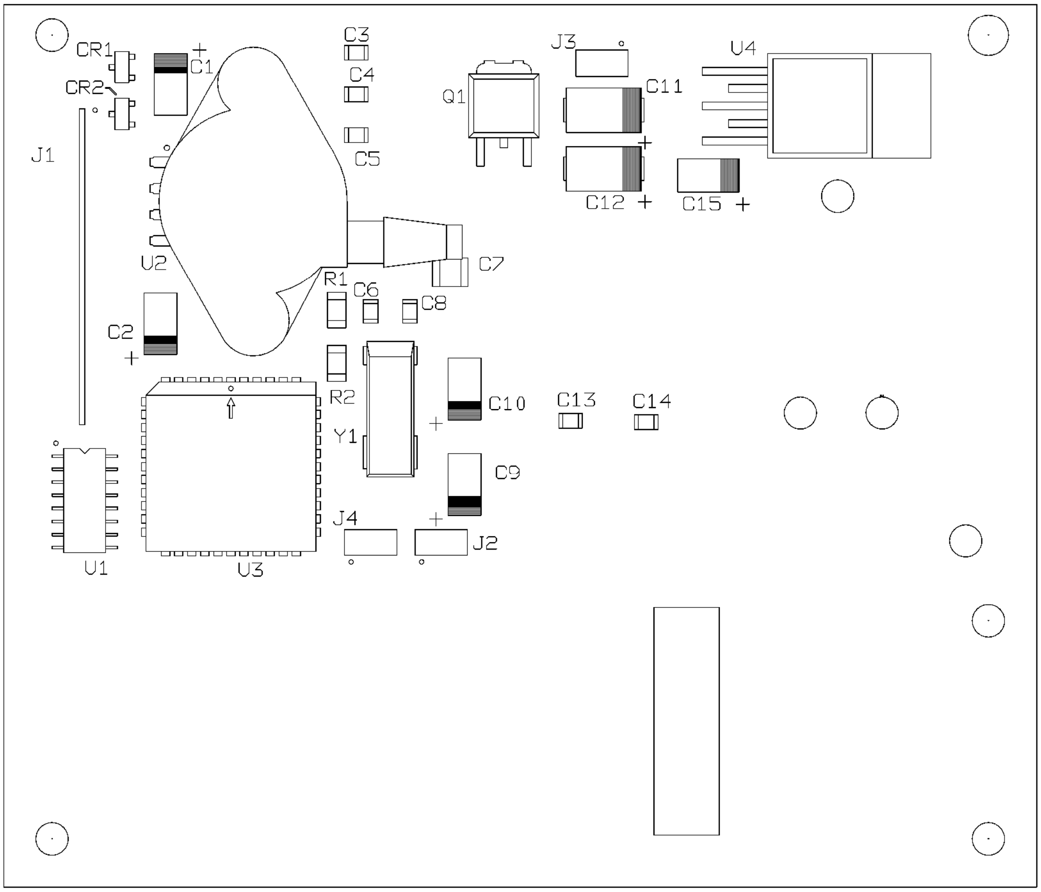

D
C
B
A
1
2
3
4
5
6
7
8
J3 - TO PUMP
J3 - 1
J3 - 2
J2,J4 - TO VALVES
J4 - 1
TO VALVE 1
J4 - 2
J2 - 1
TO VALVE 0
J2 - 2
VALVE0_DRV
VALVE1_DRV
R105 10
C103 0.1
CR100 MURS140
Q1 SMD25N05
R111 1K
C11 22 25V 10%
C12 22 25V 10%
LOW ESR CAPS REQ.
R104 10K
R100 2.74K
R101 3.01K
Q100 3904
R110 6.34K
Q101 3904
U4 LM2941CT
IN
OUT
ADJ
GND
EN
C15 4.7 20V
PWR
R119 10K
R118 10K
R129 51.1
C112 0.1
CR102 4148
Q103 3904
R136 1K
NC
R132 51.1
C113 0.1
CR101 4148
Q104 3904
R135 1K
C10 4.7 20V 20%
C9 4.7 20V 20%
C14 .01 5%
C13 .01 5%
R122 100K
R125 11.5K
R128 100K
R131 11.5K
U102 LP2951
U104 LP2951
+VIN
VOUT
ERROR
5V
SD
SENSE
GND
FB
C104 0.1
C108 0.1
C102 0.1
CR1 BAT54
CR2 BAT54
PUMP_DRV
PWR_BUS
NIBP_ENBL*
VOLT_SEL0
VOLT_SEL1

VOLT_SEL1	VOLT_SEL0	PUMP VOLTAGE
LOW	LOW	6 VOLTS
HIGH	LOW	8 VOLTS
LOW	HIGH	10 VOLTS
HIGH	HIGH	12 VOLTS

IC POWER/RETURN CHART

IC		POWER		RETURN	POWER SUPPLY BYPASS				POWER SUPPLY BYPASS			
U3	407827	3,14,25,35	+5	10,21,32,43	C110	0.1	+5	GND	C107	0.1	+5	GND
U100	LT1013	6		2	C100	0.1	VDD	GND				
U101	LT1013	6		2	C105	0.1	VDD	GND				
U103	LT1013	6		2	C109	0.1	VDD	GND				

Parts Location Diagram PN 800316-001C


CR1
C1
CR2
C3
C4
C5
Q1
J3
C11
U4
J1
C12
C15
U2
C7
R1
C6
C8
C2
R2
C10
C13
C14
Y1
C9
J4
J2
U1
U3

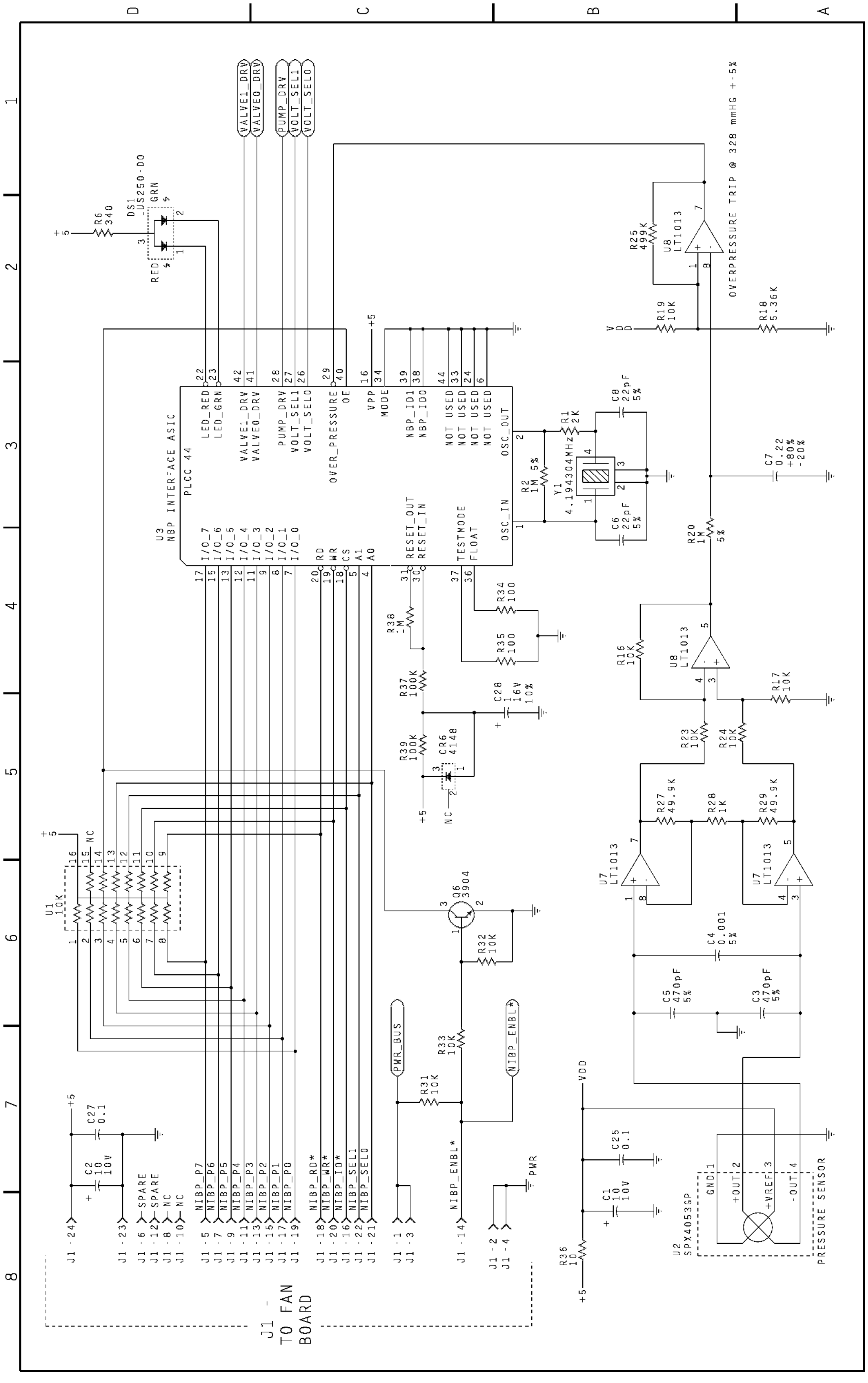
Parts List PN 800316-001C

Item	Parts List	Part Number	Qty
C1, 2	Cap, Tant, 1µF, 20%, 10V, SM	1176-106	2
C3, 5	Cap, Cer, 470pF, 5%, 50V, SM	1181-471	2
C4	Cap, Cer, 0.001µF, 5%, 50V, SM	1181-102	1
C6, 8	Cap, Cer, 22pF, 5%, 50V, SM	1181-220	2
C7	Cap, Cer, 0.22µF, 20%, 50V, SM	1187-224	1
C9, 10, 15	Cap, Tant, 4.7µF, 20%, 20V, SM	402004-001	3
C11, 12	Cap, Tant, 22µF, 10%, 25V, SM	407653-001	2
C13, 14	Cap, Cer, 0.01µF, 5%, 50V, SM	1182-103	2
C16 - 27	Cap, Cer, 0.1µF, 20%, 50V	404370-001	12
C28	Cap, Tant, 1µF, 10%, 16V, SM	403253-001	1
CR1, 2	Diode, Schottky, SM BAT54	401985-001	2
CR3	Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3	403187-001	1
CR4, 5, 6	Diode, SM MMAD4148	401980-001	3
DS1	Diode, Light-Emitting (Red/Green) LDGR 2340	402428-001	1
J1	Flex Circuit Assembly, NBP	404744-001	1
J2, 3, 4	PC Post	1778-604	6
Q1	Transistor, MOSFET, N-Channel, SM 25N05	407659-001	1
Q2 - 6	Transistor, NPN, SM T3904	2511-001	5
R1, 15, 26, 28, 30	Res, Cer, 1K, 1%, 1/8W, SM	1082-103	5
R2, 20	Res, Cer, 1M, 5%, 1/8W, SM	1081-105	2
R3	Res, Cer, 2.74K, 1%, 1/8W, SM	1082-823	1
R4	Res, Cer, 3.01K, 1%, 1/8W, SM	1082-821	1
R5, 7, 9, 16, 17, 19, 23, 24, 31, 32, 33	Res, Cer, 10K, 1%, 1/8W, SM	1082-104	11
R6	Res, 340Ω, 1%, 1/8W, SM	1082-790	1
R8	Res, Cer, 6.34K, 1%, 1/8W, SM	1082-822	1
R10, 12, 37, 39	Res, Cer, 100K, 1%, 1/8W, SM	1082-100	4
R11, 13	Res, Cer, 11.5K, 1%, 1/8W, SM	1082-815	2
R14, 36	Res, Cer, 10Ω, 1%, 1/8W, SM	1082-786	2
R18	Res, Cer, 5.36K, 1%, 1/8W, SM	1082-785	1
R21, 22	Res, Cer, 51.1Ω, 10%, 1/4W, SM	1082-789	2
R25	Res, Cer, 499K, 1%, 1/8W, SM	1082-499	1
R27, 29	Res, Cer, 49.9K, 1%, 1/8W, SM	1082-498	2
R34, 35	Res, Cer, 100Ω, 1%, 1/8W, SM	1082-755	2
R38	Res, Cer, 1M, 1%, 1/8W, SM	1082-828	1
U1	Res Ntwk, 10K	1061-103	1
U2	Sensor, Pressure, 7.3PSI, Compensated	404406-004	1
U3	FPGA, Programmed, NBP, PLCC	407827-001	1
U4	Volt Rgltr, Adj, TO220 LM2941CT	403609-001	1
U5, 6	Volt Rgltr, Adj, SM LP2951A	3076-001	2
U7, 8	Operation Ampl, SM LT1013	3137-013	2

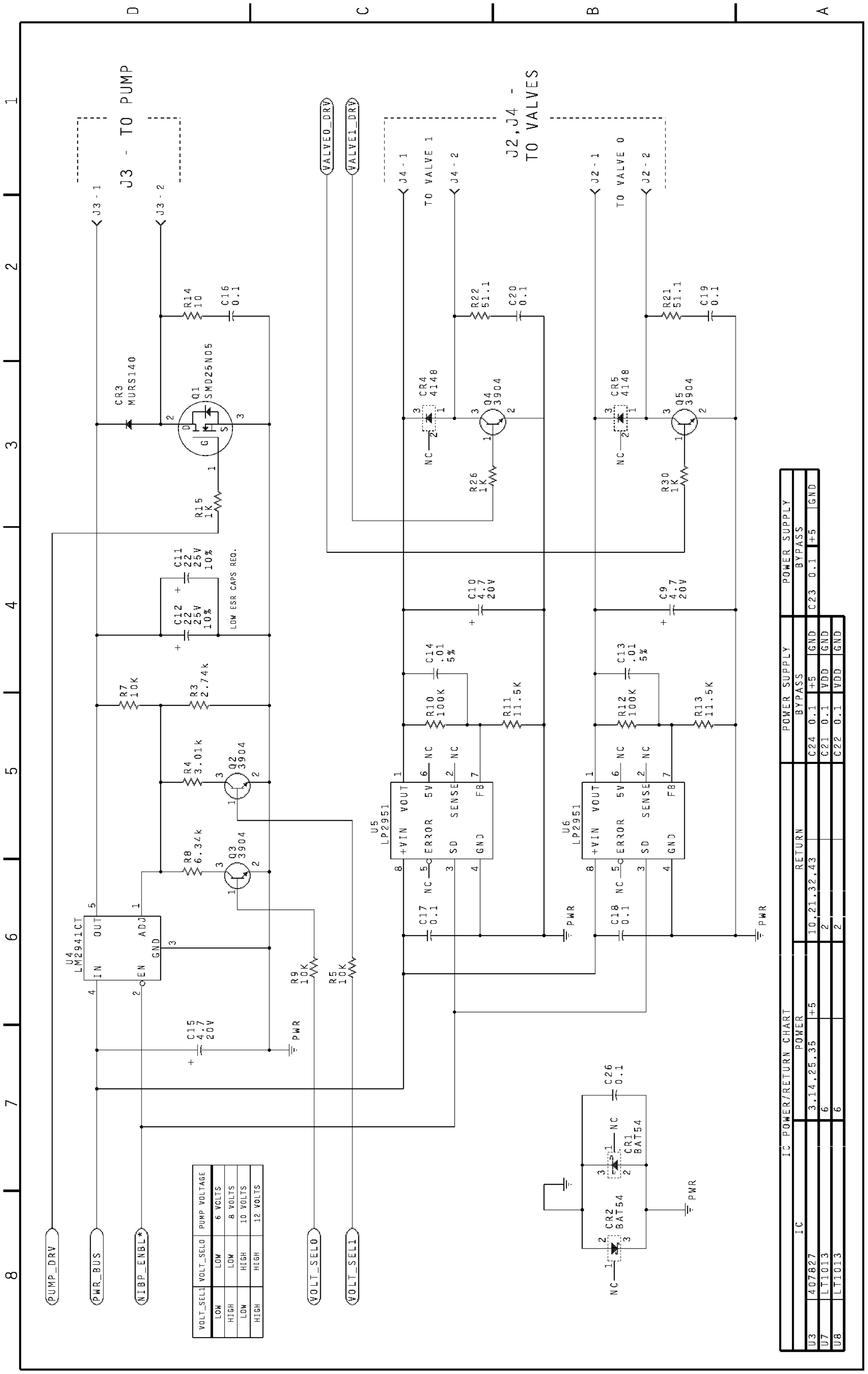
Item	Parts List	Part Number	Qty
Y1	Crystal, 4.194304MHz, SM	407658-001	1
-	Insert, Threaded, 4-40	404158-001	3
-	Screw, PNH, Phillips, 4-40 x 1/4 (for U4)	45000-404	1
-	Screw, PNH, Phillips, 4-40 x 1/2 (for U2)	45000-408	2
-	Washer, Flat, SST, No 4 (for U2, 4)	4520-004	3
-	Circuit Board	800317-001C	1
-	Schematic Diagram	SD800316-001C	-

Schematic Diagram PN SD800316-001C

1 of 2


D
C
B
A
1
2
3
4
5
6
7
8
VALVE1_DRV
VALVE0_DRV
PUMP_DRV
VOLT_SEL1
VOLT_SEL0
OVERPRESSURE TRIP @ 328 mmHG +-5%
R6 340
DS1 LUS250-DO
GRN
RED
+5
U3 NBP INTERFACE ASIC PLCC 44
LED_RED
LED_GRN
OVER_PRESSURE
OE
VPP
MODE
NBP_ID1
NBP_ID0
NOT USED
OSC_OUT
OSC_IN
I/O_7
I/O_6
I/O_5
I/O_4
I/O_3
I/O_2
I/O_1
I/O_0
RD
WR
CS
A1
A0
RESET_OUT
RESET_IN
TESTMODE
FLOAT
R1 2K
R2 1M 5%
Y1 4.194304MHz
C8 22pF 5%
C6 22pF 5%
C7 0.22 +80% -20%
R25 499K
U8 LT1013
R19 10K
R18 5.36K
VDD
R20 1M 5%
R16 10K
R17 10K
R23 10K
R24 10K
R27 49.9K
R28 1K
R29 49.9K
U7 LT1013
C4 0.001 5%
C5 470pF 5%
C3 470pF 5%
R34 100
R35 100
R38 1M
R37 100K
R39 100K
CR6 4148
C28 1 16V 10%
NC
U1 10K
Q6 3904
R32 10K
R33 13K
R31 10K
PWR_BUS
NIBP_ENBL*
C27 0.1
C2 10 10V
C25 0.1
C1 10 10V
R36 10
J2 SPX4053GP
GND
+OUT
+VREF
-OUT
PRESSURE SENSOR
J1 - 24
J1 - 23
J1 - 6 SPARE
J1 - 12 SPARE
J1 - 8 NC
J1 - 10 NC
J1 - 5 NIBP_P7
J1 - 7 NIBP_P6
J1 - 9 NIBP_P5
J1 - 11 NIBP_P4
J1 - 13 NIBP_P3
J1 - 15 NIBP_P2
J1 - 17 NIBP_P1
J1 - 19 NIBP_P0
J1 - 18 NIBP_RD*
J1 - 20 NIBP_WR*
J1 - 16 NIBP_IO*
J1 - 22 NIBP_SEL1
J1 - 21 NIBP_SEL0
J1 - 1
J1 - 3
J1 - 14 NIBP_ENBL*
J1 - 2
J1 - 4
PWR
J1 - TO FAN BOARD

2 of 2


J3 - TO PUMP
J3-1
J3-2
J2,J4 - TO VALVES
J4-1
TO VALVE 1
J4-2
J2-1
TO VALVE 0
J2-2
VALVE0_DRV
VALVE1_DRV
CR3 MURS140
Q1 SMD25N05
R14 10
C16 0.1
R15 1K
C11 22 25V 10%
C12 22 25V 10%
LOW ESR CAPS REQ.
R7 10K
R3 2.74k
R4 3.01k
Q2 3904
R8 6.34k
Q3 3904
U4 LM2941CT
IN
OUT
ADJ
GND
EN
C15 4.7 20V
PWR
R9 10K
R5 10K
CR4 4148
Q4 3904
R22 51.1
C20 0.1
R26 1K
NC
C10 4.7 20V
C14 .01 5%
R10 100K
R11 11.5K
U5 LP2951
+VIN
VOUT
ERROR
5V
SD
SENSE
GND
FB
C17 0.1
CR5 4148
Q5 3904
R21 51.1
C19 0.1
R30 1K
C9 4.7 20V
C13 .01 5%
R12 100K
R13 11.5K
U6 LP2951
C18 0.1
C26 0.1
CR1 BAT54
CR2 BAT54
PUMP_DRV
PWR_BUS
NIBP_ENBL*
VOLT_SEL0
VOLT_SEL1
D
C
B
A
1
2
3
4
5
6
7
8

VOLT_SEL1	VOLT_SEL0	PUMP VOLTAGE
LOW	LOW	6 VOLTS
HIGH	LOW	8 VOLTS
LOW	HIGH	10 VOLTS
HIGH	HIGH	12 VOLTS

IC POWER/RETURN CHART

	IC	POWER		RETURN	POWER SUPPLY BYPASS			POWER SUPPLY BYPASS		
U3	407827	3,14,25,35	+5	10,21,32,43	C24 0.1	+5	GND	C23 0.1	+5	GND
U7	LT1013	6		2	C21 0.1	VDD	GND			
U8	LT1013	6		2	C22 0.1	VDD	GND			

For your notes

29

ACQUISITION PROCESSOR PCB PN 801040/800330

General 29-2

Parts Location Diagram PN 801040-001A/002A 29-3

Parts List PN 801040-001A/002A 29-5

Schematic Diagram PN SD801040-001A 29-7

Assembly Configurations PN800330..29-19

Parts Location Diagram PN 800330B 29-20

Parts List PN 800330B 29-22

Schematic Diagram PN SD800330-001B 29-24

General

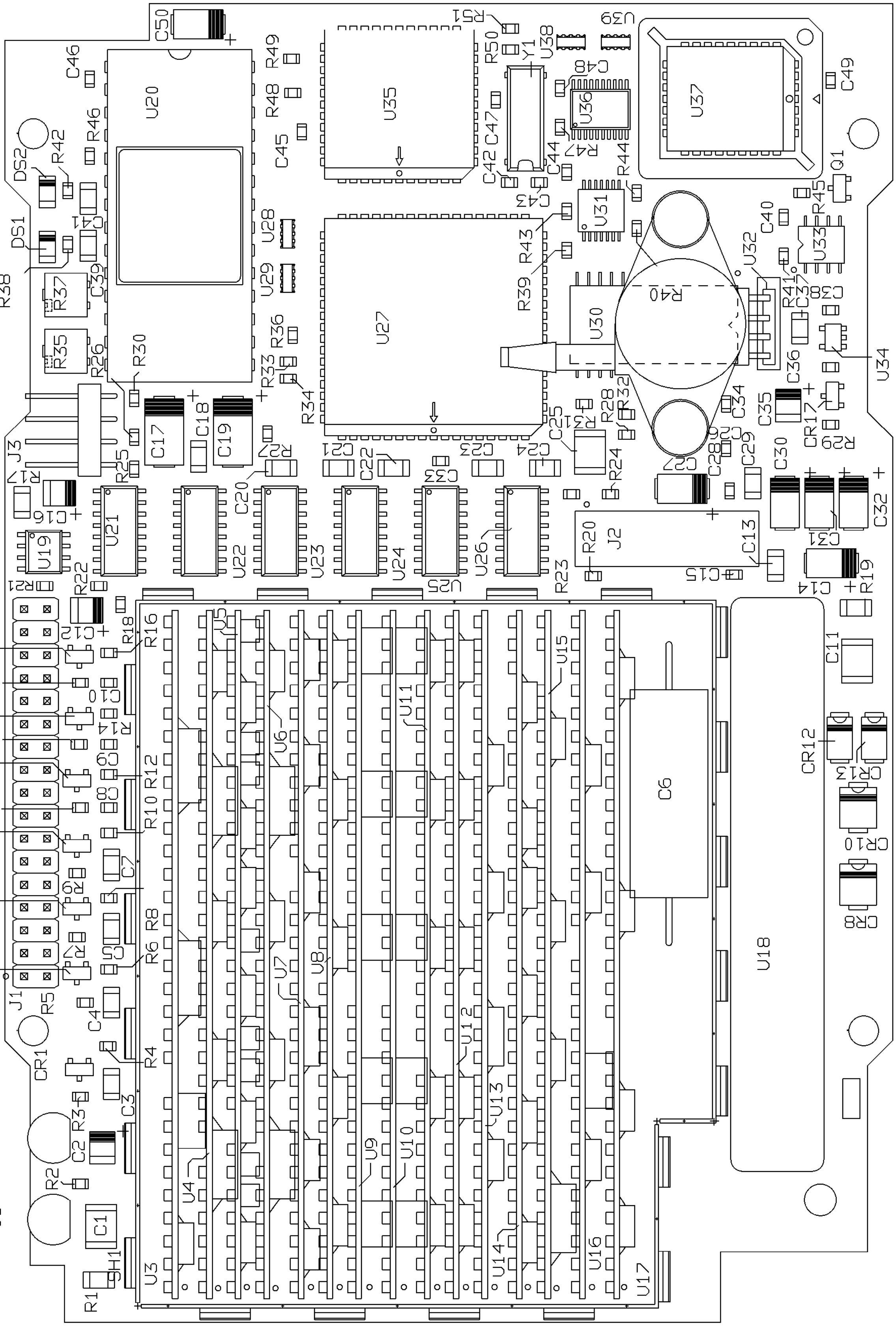
There are many different versions of the acquisition processor PCB:

- pn 800330-0XX, were used first in all Tram modules; and
- pn 801040-001, was introduced in the SL-series modules for all 10-leadwire configurations; and
- pn 801040-002, was introduced in the A-series modules for Tram 800A/850A 5-leadwire configurations.

NOTE
You may replace any Tram 800A/850A 5-lead version of the pn 800330 board with a pn 801040-002 board and any 10-lead version of the pn 800330 board with a pn 801040-001 board.

Parts Location Diagram PN 801040-001A/002A

1 of 2


C50
R51
U39
R49
R50
Y1
U38
C46
U20
R48
U35
C48
U36
U37
C49
C47
C45
R46
R42
DS2
C42
C44
R47
R44
C43
Q1
R45
C41
C40
U31
U28
DS1
U33
R43
U32
C39
R38
R37
U29
R41
C37
C38
R39
R40
R36
U27
U30
R35
R26
R30
R33
C36
U34
R34
C17
C18
C19
C25
R28
R32
C34
C35
R31
CR17
R27
C21
C22
C23
C24
R29
J3
R25
C26
C29
C30
C33
C20
R24
C27
C28
R17
C16
U21
U22
U23
U24
U25
U26
J2
C13
C32
C31
U19
R20
R22
R21
R23
C15
C14
R19
CR15
C12
R18
R16
U5
U15
C11
R15
CR14
C10
U11
R14
R13
U6
CR12
CR11
C9
R12
CR13
R11
C8
C6
CR9
R10
CR10
C7
CR6
R9
R8
CR8
R7
C5
U18
CR4
R6
U7
U8
J1
R5
C4
U12
CR1
R4
U13
C3
U2
R3
C2
U10
U9
U4
R2
U1
C1
SH1
U3
U14
U16
U17
R1

2 of 2

INSTALL ITEM 67
AT DESIGNATED
LOCATIONS
(30 PL.)
SEE CHART A

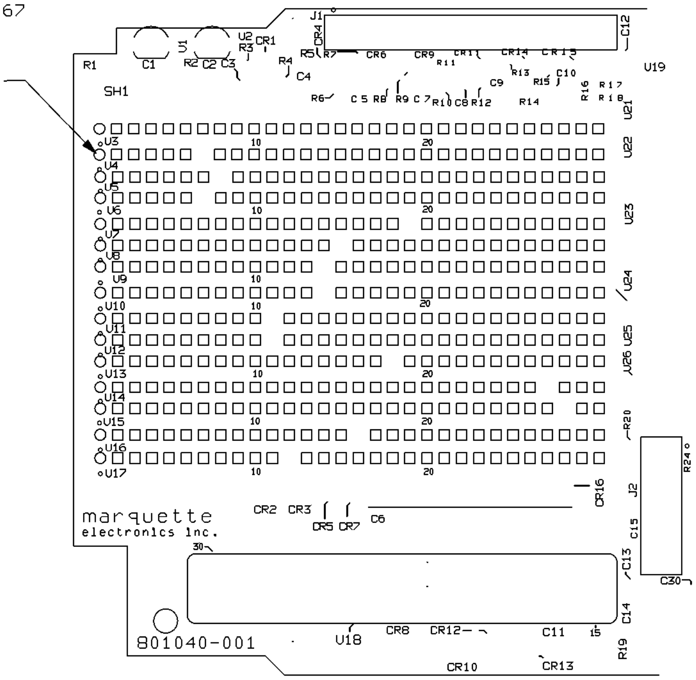
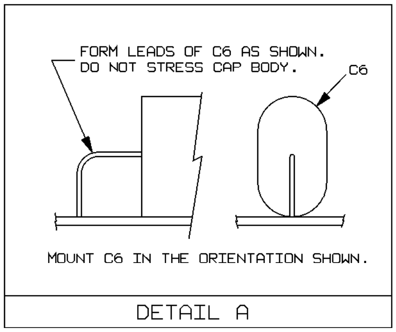

J1
C12
U19
R1
C1
R2
C2
C3
U2
CR1
R3
R4
C4
CR4
R5
R7
CR6
CR9
CR11
CR14
CR15
R11
R13
C10
C9
R15
R16
R17
R18
SH1
R6
C5
R8
R9
C7
R10
C8
R12
R14
U21
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
10
20
U22
U23
U24
U25
U26
R20
R24
J2
CR16
C15
C13
C30
C14
marquette
electronics inc.
CR2
CR3
CR5
CR7
C6
30
801040-001
U18
CR8
CR12
C11
15
R19
CR10
CR13

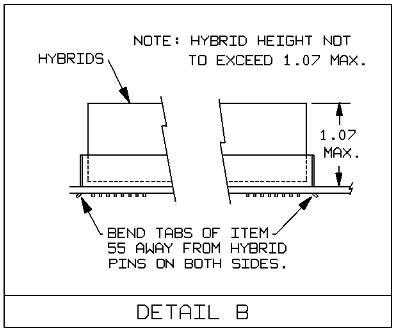
CHART A	
U3	5,30
U4	1,28
U5	1,27
U6	1,28
U7	11,30
U8	2,30
U9	1,29
U10	1,29
U11	1,29
U12	1,29
U13	7,30
U14	15,26
U15	12,26
U16	14,29
U17	3,27

SOCKET PIN LOCATIONS

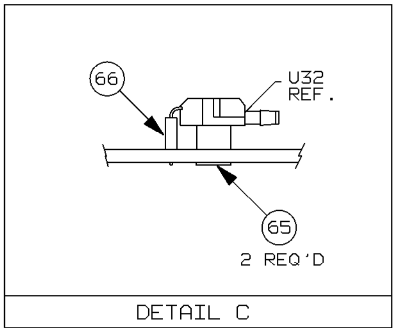

FORM LEADS OF C6 AS SHOWN.
DO NOT STRESS CAP BODY.

MOUNT C6 IN THE ORIENTATION SHOWN.

DETAIL A


NOTE: HYBRID HEIGHT NOT
TO EXCEED 1.07 MAX.
HYBRIDS
1.07
MAX.
BEND TABS OF ITEM
55 AWAY FROM HYBRID
PINS ON BOTH SIDES.

DETAIL B


66
U32
REF.
65
2 REQ'D

DETAIL C

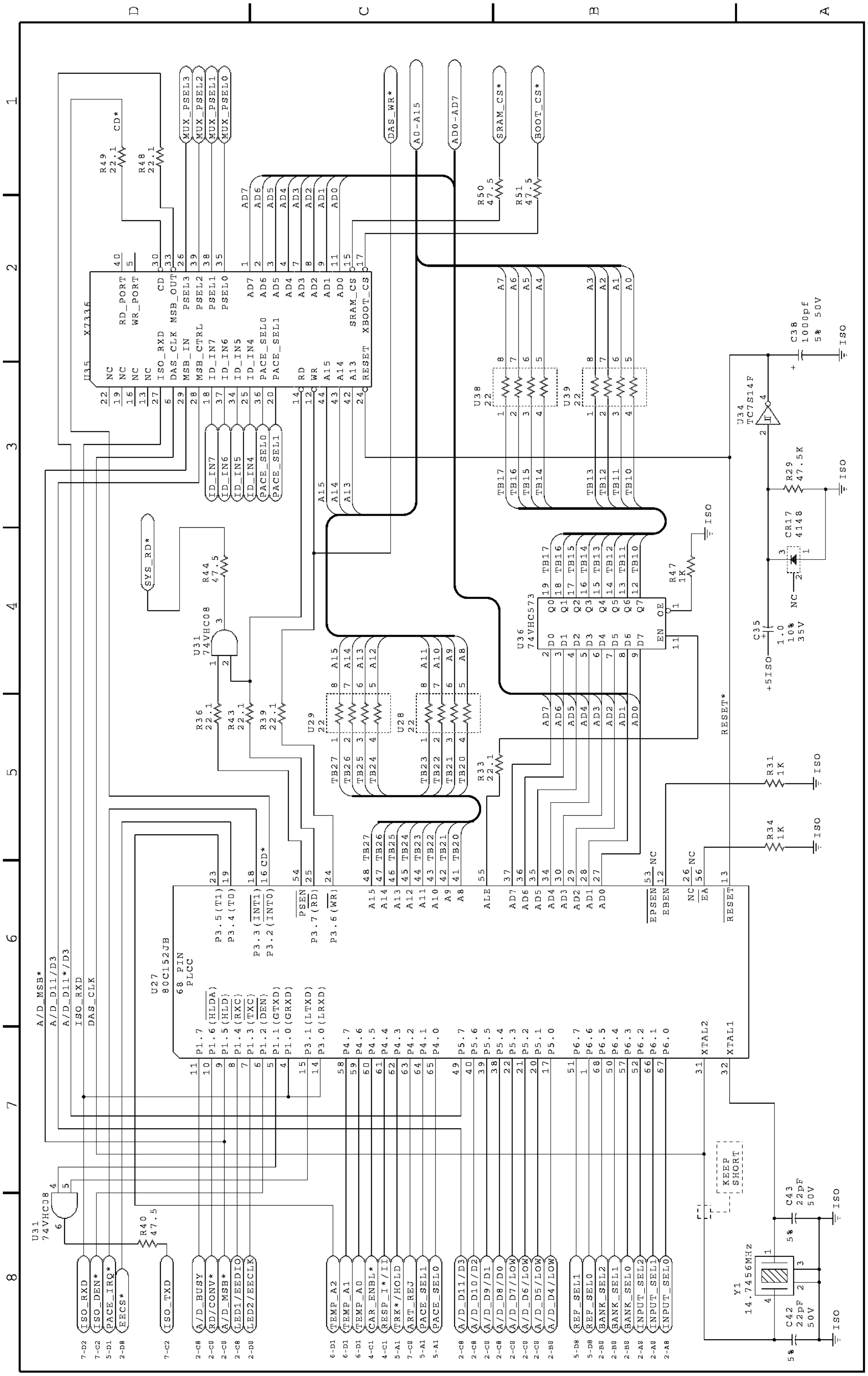
Parts List PN 801040-001A/002A

Item	Parts List	Part Number	Qty
C1, 11, 25	Cap, Cer, 0.47µF, 20%	1187-474	3
C2, 35	Cap, Tant, 1.0µF, 10%, 35V, SM	403907-001	2
C3-5, 7, 13, 18, 2024, 29, 37, 39, 41	Cap, Cer, 0.1µF, 20%, 50V	404370-001	15
C6	Cap, MPE, 10µF, 5%, 35V	1215-106	1
C8-10, 15, 26, 28, 33, 34, 36, 40, 44, 45-49	Cap, Cer, 0.1µF, 5%, 16V	411575-002	16
C12, 16	Cap, Tant, 3.3µF, 10%, 20V, SM	416798-001	2
C14, 27, 30, 50	Cap, Tant, 10µF, 20%, 16V, SM	1176-106	4
C17, 19	Cap, Tant, 10µF, 20%, 25V, SM	1152-106	1
C31, 32	Cap, Tant, 4.7µF, 20%, 20V, SM	402004-001	2
C38	Cap, Cer, 1000pF, 5%, 50V, SM	411575-003	1
C42, 43	Cap, NPO, 22pF, 5%, 50V, SM	411576-002	2
CR1, 4, 6, 9, 11, 14, 15	Diode Pair, Series, SM D7000	2013-201	7
CR8, 10	Transorb, 15V, 5%, 600W SM6T15A	403188-001	2
CR12, 13	Diode, Rectifier, 1A, 100V, SM MURS110T3	403190-001	2
CR17	Diode, SM MMAD4148	401980-001	1
DS1, 2	Light-Emitting Diode, Red, SM 1206	414417-002	2
J1	Connector, PC Header, 34-Pin, Vertical	1778-234	1
J2	Connector, Vertical, 16-Pin	1847-016	1
J3	PC Post, Right Angle	1778-436	4
Q1	Transistor, PNP, SM T3906	2511-101	1
R1	Res, Cer, 243K, 1%, 1/8W, SM	1082-798	1
R17	Res, Cer, 2K, 1%, 1/8W, SM	1082-201	1
R19	Res, Cer, 499K, 1%, 1/8W, SM	1082-499	1
R2, 21	Res, Cer, 100Ω, 1%, 1/16W, SM	410334-003	2
R3, 5, 7, 9, 11, 13, 15, 18, 22, 27, 31, 34, 38, 41, 42, 47	Res, Cer, 1K, 1%, 1/16W, SM	410334-008	16
R4, 6, 8, 10, 12, 14, 16, 25, 28, 32, 45, 46	Res, Cer, 11.5K, 1%, 1/16W, SM	410334-014	12
R20, 23, 24, 26	Res, Cer, 150Ω, 1%, 1/16W, SM	410334-028	4
R29, 30	Res, Cer, 45.7K, 1%, 1/16W, SM	410334-036	2
R33, 36, 39, 43, 48, 49	Res, Cer, 22.1 Ω, 1%, 1/16W, SM	410334-033	6
R35, 37	Res, Var, 100Ω, 11-Turn	416248-001	2
R40, 44, 50, 51	Res, Cer, 47.5Ω, 1%, 1/16W, SM	410334-026	4
SH1	Shield, Fence	416402-001	1
U1	Sensor, Temperature, TO92 LM35CZ	403396-001	1
U2	Volt Rgltr, +5V, 0.5%, 100mA, TO92 LP2950	402581-001	1
U3	Hybrid, NBP	404303-001	1
U4, 5	Hybrid, Dual Invasive BP Amplifier	400867-001	2

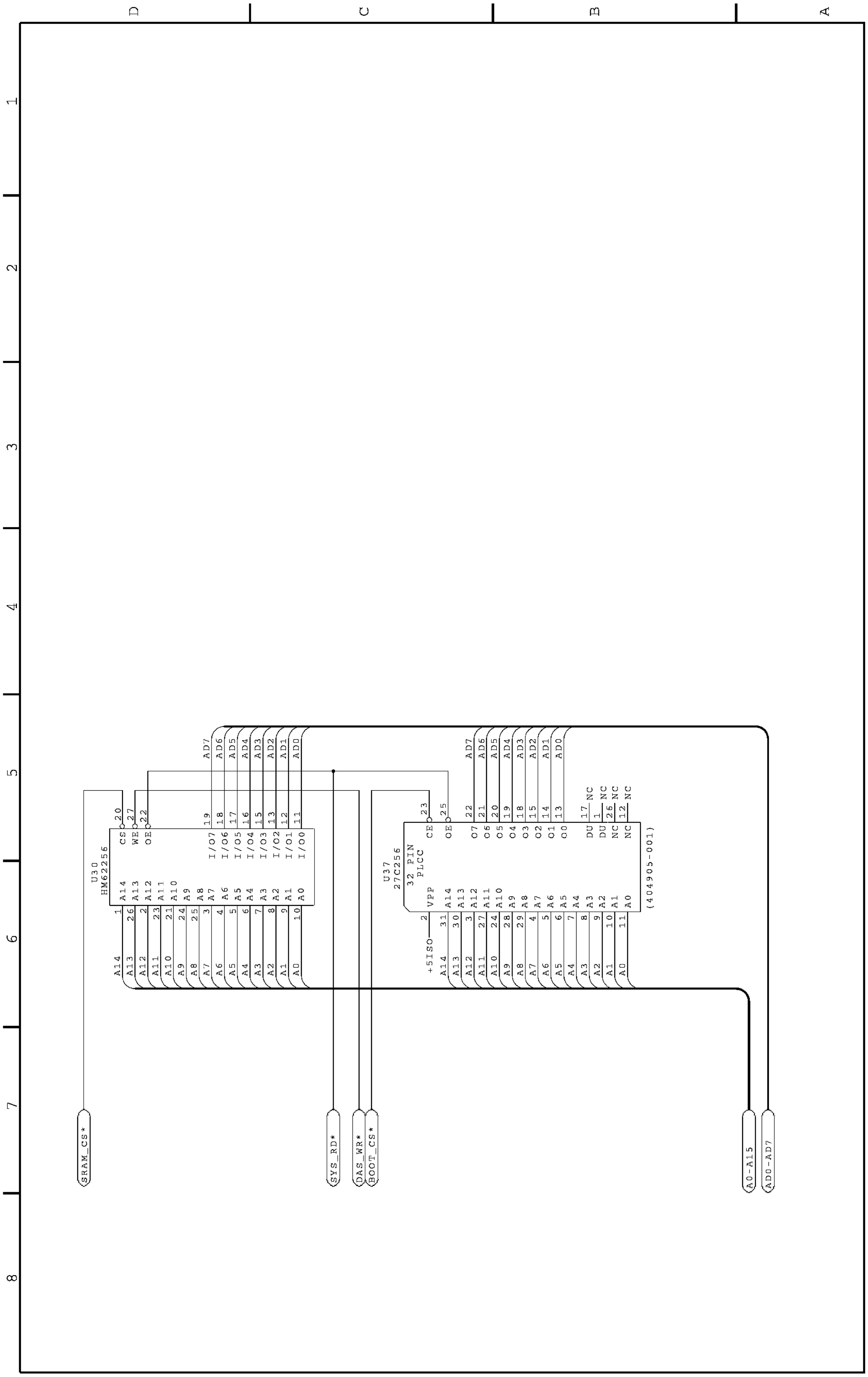
Item	Parts List	Part Number	Qty
U5	Hybrid, Quad Invasive BP Driver (For -001 Only)	401607-001	1
U7	Hybrid, TEMP, Channel 2	402100-004	1
U8	Hybrid, TEMP, Channel 1	401788-004	1
U9, 10	Hybrid, ECG Final Amplifier	401787-001	2
U11, 12	Hybrid, ECG Pacemaker Rejection (For -001 Only)	401786-001	2
U12	Hybrid, ECG Pacemaker Rejection (For -002 Only)	401786-001	1
U13	Hybrid, Pace Detect	800982-001	1
U14	Hybrid, ECG Preamplifier II (For -001 Only)	401790-001	1
U15	Hybrid, ECG Preamplifier	400869-004	1
U16	Hybrid, RESP Carrier	400870-001	1
U17	Hybrid, RESP Demodulator (For -001 Only)	400871-004	1
U18	ECG Defib Protection, 10-Lead (For -001 Only)	414639-002	1
U18	ECG Defib Protection, 5-Lead (For -002 Only)	414639-001	1
U19	Operational Ampl, JFET, SM LT1055	402396-001	1
U20	ADC, 12-Bit, Custom	405548-001	1
U21-26	Analog Multiplexer, 4-Channel, Dual, SM DG408DY/ 508DY	402024-001	6
U27	PAL, Programmed, Communication Control, PLCC 80C152JB	400368-001	1
U28, 29, 38, 39	Res Ntwk, 22 Ω, SM	415601-001	4
U30	RAM, Static, 32K x 8-Bit , SM 62256FLP	3202-256	1
U31	AND Gate, 2-Input, Quad, SM VHC08	3057-008	1
U32	Sensor, Pressure, 7.3 PSI	40446-003	1
U33	EEPROM, Serial, 64 x 16-Bit, SM 93C46	406286-001	1
U34	Inverter, Schmitt Trigger, CMOS, SM TC7S14	416170-001	1
U35	EPLD, Programmed, Acquisition Processor, PLCC	416957-001	1
U36	Latch, Type D, Octal VHC573	3057-573	1
U37	EPROM, Programmed, Acquisition Processor Boot Code, PLCC	404905-001	1
Y1	Crystal, 14.7456-MHz, SM	414847-002	1
–	Socket, PLCC, 32-Pin, SM (for)	403802-001	1
–	Spacer, Round, 6-32 x 1/4 (For U32)	4663-604	2
–	Socket, 4-Pin	413139-001	1
–	Socket, Mini (For U3-17)	1818-201	30
–	Shield, Cover	416402-002	1
–	Circuit Board	801041-001A	1
–	Schematic Diagram	SD801040-001A	–

Schematic Diagram PN SD801040-001A

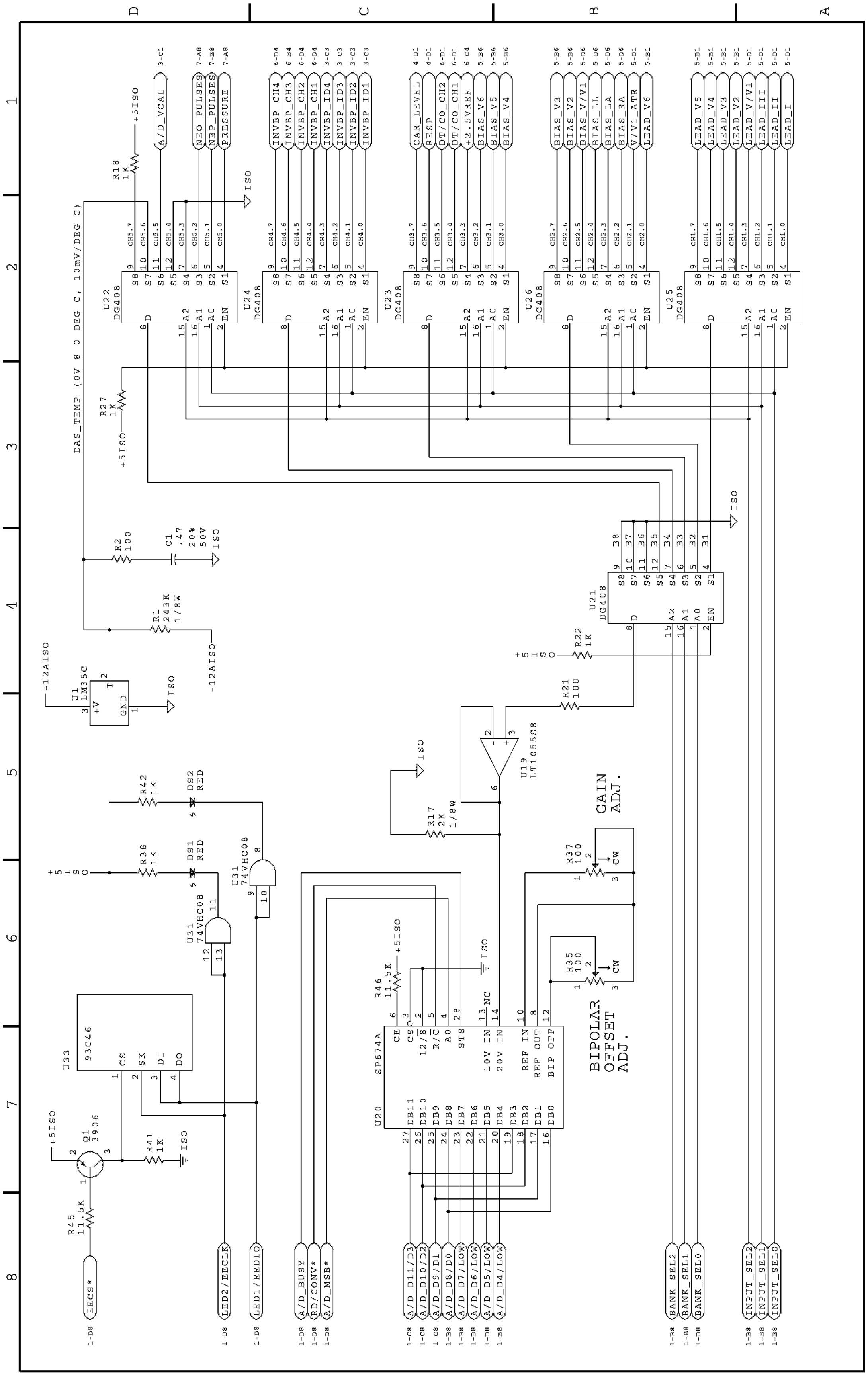
1 of 11


D
C
B
A
1
2
3
4
5
6
7
8
U35 X7336
U27 80C152JB 68 PIN PLCC
U36 74VHC573
U31 74VHC08
U31 74VHC38
U34 TC7S14F
U38 22
U39 22
U29 22
U28 22
Y1 14.7456MHz
MUX_PSEL3
MUX_PSEL2
MUX_PSEL1
MUX_PSEL0
DAS_WR*
A0-A15
AD0-AD7
SRAM_CS*
BOOT_CS*
CD*
SYS_RD*
ID_IN7
ID_IN6
ID_IN5
ID_IN4
PACE_SEL0
PACE_SEL1
R49 22.1
R48 22.1
R50 47.5
R51 47.5
R44 47.5
R36 22.1
R43 22.1
R39 22.1
R33 22.1
R47 1K
R29 47.5K
R31 1K
R34 1K
R40 47.5
C38 1000pf 5% 50V
C35 1.0 10% 35V
C43 22pF 5% 50V
C42 22pF 5% 50V
CR17 4148
ISO
+5ISO
RESET*
KEEP SHORT
A/D_MSB*
A/D_D11/D3
A/D_D11*/D3
ISO_RXD
DAS_CLK
ISO_RXD
ISO_DEN*
PACE_IRQ*
EECS*
ISO_TXD
A/D_BUSY
RD/CONV*
A/D_MSB*
LED1/EEDIO
LED2/EECLK
TEMP_A2
TEMP_A1
TEMP_A0
CAR_ENBL*
RESP_I*/II
TRK*/HOLD
ART_REJ
PACE_SEL1
PACE_SEL0
A/D_D11/D3
A/D_D10/D2
A/D_D9/D1
A/D_D8/D0
A/D_D7/LOW
A/D_D6/LOW
A/D_D5/LOW
A/D_D4/LOW
REF_SEL1
REF_SEL0
BANK_SEL2
BANK_SEL1
BANK_SEL0
INPUT_SEL2
INPUT_SEL1
INPUT_SEL0

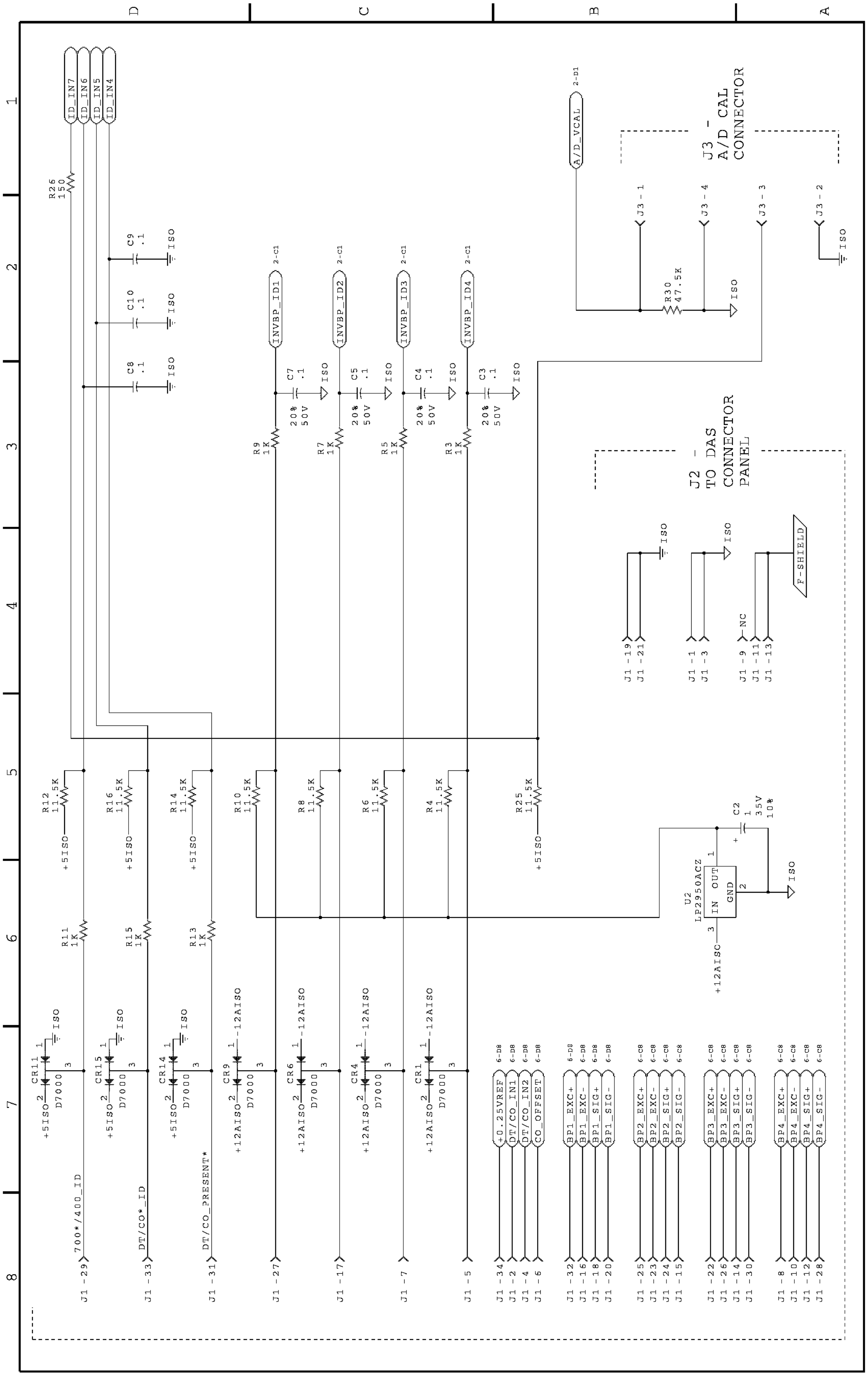
2 of 12


D
C
B
A
1
2
3
4
5
6
7
8
U30
HM62256
CS
WE
OE
I/O7
I/O6
I/O5
I/O4
I/O3
I/O2
I/O1
I/O0
U37
27C256
32 PIN
PLCC
CE
OE
VPP
+5ISO
(404905-001)
AD7
AD6
AD5
AD4
AD3
AD2
AD1
AD0
A14
A13
A12
A11
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
DU
NC
SRAM_CS*
SYS_RD*
DAS_WR*
BOOT_CS*
A0-A15
AD0-AD7

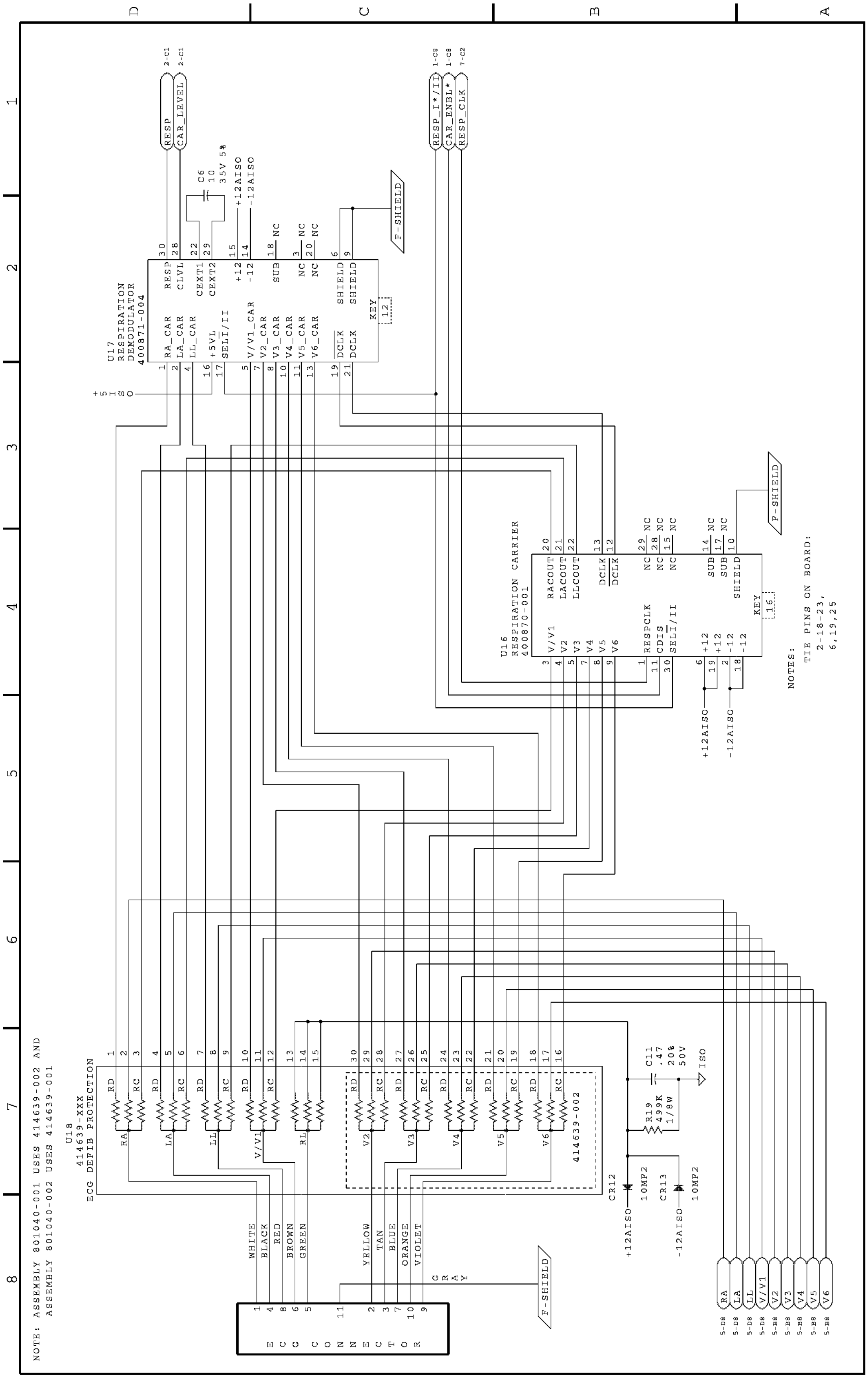
3 of 12


D
C
B
A
1
2
3
4
5
6
7
8
+5ISO
R18
1K
A/D_VCAL
NEO_PULSES
NBP_PULSES
PRESSURE
INVBP_CH4
INVBP_CH3
INVBP_CH2
INVBP_CH1
INVBP_ID4
INVBP_ID3
INVBP_ID2
INVBP_ID1
CAR_LEVEL
RESP
DT/CO_CH2
DT/CO_CH1
+2.5VREF
BIAS_V6
BIAS_V5
BIAS_V4
BIAS_V3
BIAS_V2
BIAS_V/V1
BIAS_LL
BIAS_LA
BIAS_RA
V/V1_ATR
LEAD_V6
LEAD_V5
LEAD_V4
LEAD_V3
LEAD_V2
LEAD_V/V1
LEAD_III
LEAD_II
LEAD_I
ISO
DAS_TEMP (0V @ 0 DEG C, 10mV/DEG C)
U22
DG408
U24
DG408
U23
DG408
U26
DG408
U25
DG408
U21
DG408
S8
S7
S6
S5
S4
S3
S2
S1
D
A2
A1
A0
EN
B8
B7
B6
B5
B4
B3
B2
B1
R27
1K
R2
100
C1
.47
20%
50V
R1
243K
1/8W
-12AISO
+12AISO
U1
LM35C
+V
T
GND
R22
1K
R21
100
U19
LT1055S8
R17
2K
1/8W
GAIN ADJ.
R37
100
CW
R35
100
BIPOLAR OFFSET ADJ.
R42
1K
DS2
RED
R38
1K
DS1
RED
U31
74VHC08
U33
93C46
CS
SK
DI
DO
R46
11.5K
U20
SP674A
CE
CS
12/8
R/C
A0
STS
10V IN
20V IN
REF IN
REF OUT
BIP OFF
NC
DB11
DB10
DB9
DB8
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
Q1
3906
R41
1K
R45
11.5K
EECS*
LED2/EECLK
LED1/EEDIO
A/D_BUSY
RD/CONV*
A/D_MSB*
A/D_D11/D3
A/D_D10/D2
A/D_D9/D1
A/D_D8/D0
A/D_D7/LOW
A/D_D6/LOW
A/D_D5/LOW
A/D_D4/LOW
BANK_SEL2
BANK_SEL1
BANK_SEL0
INPUT_SEL2
INPUT_SEL1
INPUT_SEL0

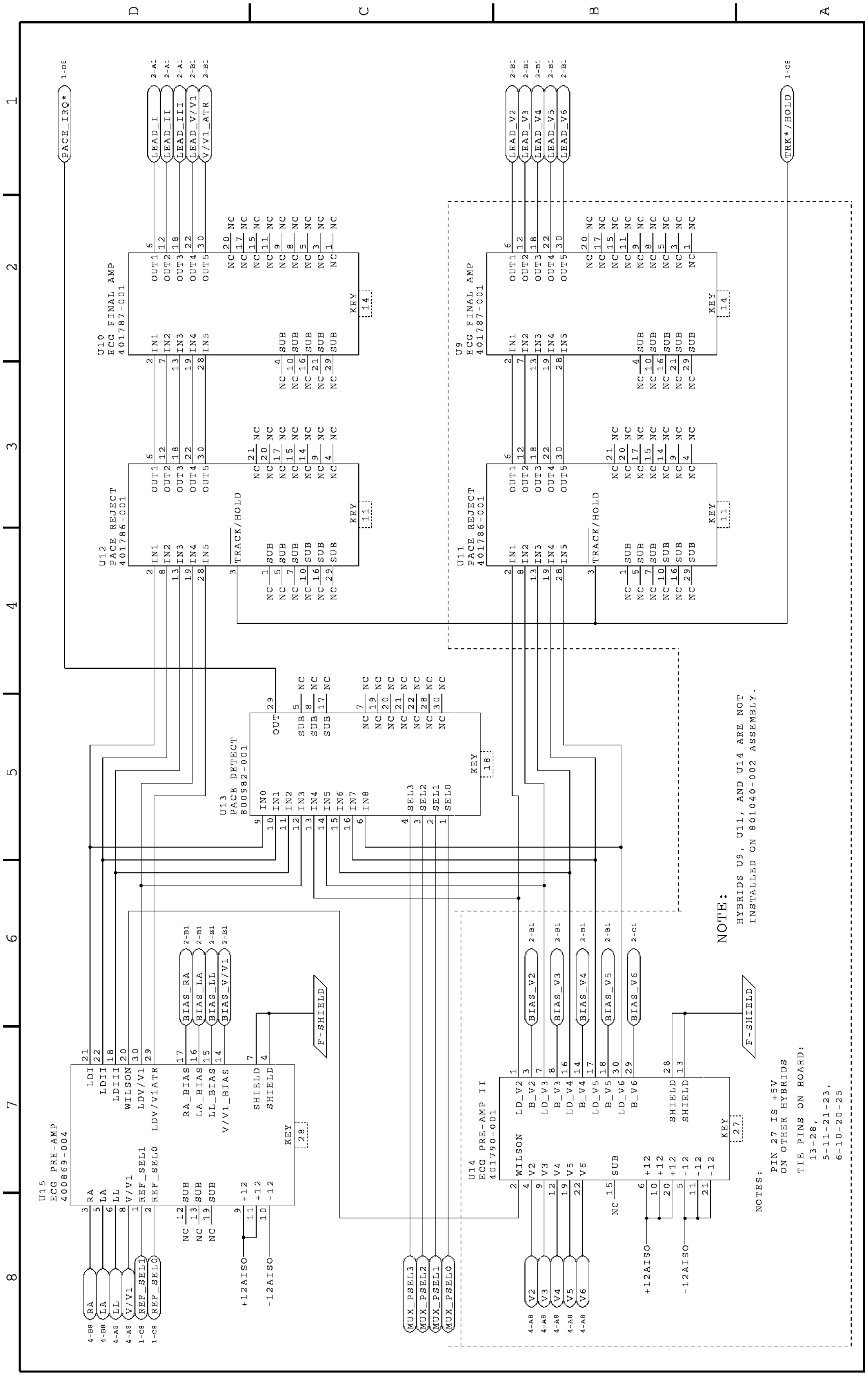
4 of 12


D
C
B
A
1
2
3
4
5
6
7
8
ID_IN7
ID_IN6
ID_IN5
ID_IN4
R26 150
C9 .1
C10 .1
C8 .1
ISO
INVBP_ID1
INVBP_ID2
INVBP_ID3
INVBP_ID4
2-C1
C7 .1
C5 .1
C4 .1
C3 .1
20% 50V
R9 1K
R7 1K
R5 1K
R3 1K
A/D_VCAL
2-D1
J3 - A/D CAL CONNECTOR
J3 - 1
J3 - 4
J3 - 3
J3 - 2
R30 47.5K
J2 - TO DAS CONNECTOR PANEL
F-SHIELD
NC
J1 - 19
J1 - 21
J1 - 1
J1 - 3
J1 - 9
J1 - 11
J1 - 13
R12 11.5K
R16 11.5K
R14 11.5K
R10 11.5K
R8 11.5K
R6 11.5K
R4 11.5K
R25 11.5K
+5ISO
C2 1 35V 10%
U2 LP2950ACZ
IN OUT GND
+12AISC
R11 1K
R15 1K
R13 1K
CR11
CR15
CR14
CR9
CR6
CR4
CR1
D7000
+12AISO
700*/400_ID
DT/CO*_ID
DT/CO_PRESENT*
+0.25VREF
DT/CO_IN1
DT/CO_IN2
CO_OFFSET
BP1_EXC+
BP1_EXC-
BP1_SIG+
BP1_SIG-
BP2_EXC+
BP2_EXC-
BP2_SIG+
BP2_SIG-
BP3_EXC+
BP3_EXC-
BP3_SIG+
BP3_SIG-
BP4_EXC+
BP4_EXC-
BP4_SIG+
BP4_SIG-
6-D8
6-C8
J1 - 29
J1 - 33
J1 - 31
J1 - 27
J1 - 17
J1 - 7
J1 - 5
J1 - 34
J1 - 2
J1 - 4
J1 - 6
J1 - 32
J1 - 16
J1 - 18
J1 - 20
J1 - 25
J1 - 23
J1 - 24
J1 - 15
J1 - 22
J1 - 26
J1 - 14
J1 - 30
J1 - 8
J1 - 10
J1 - 12
J1 - 28

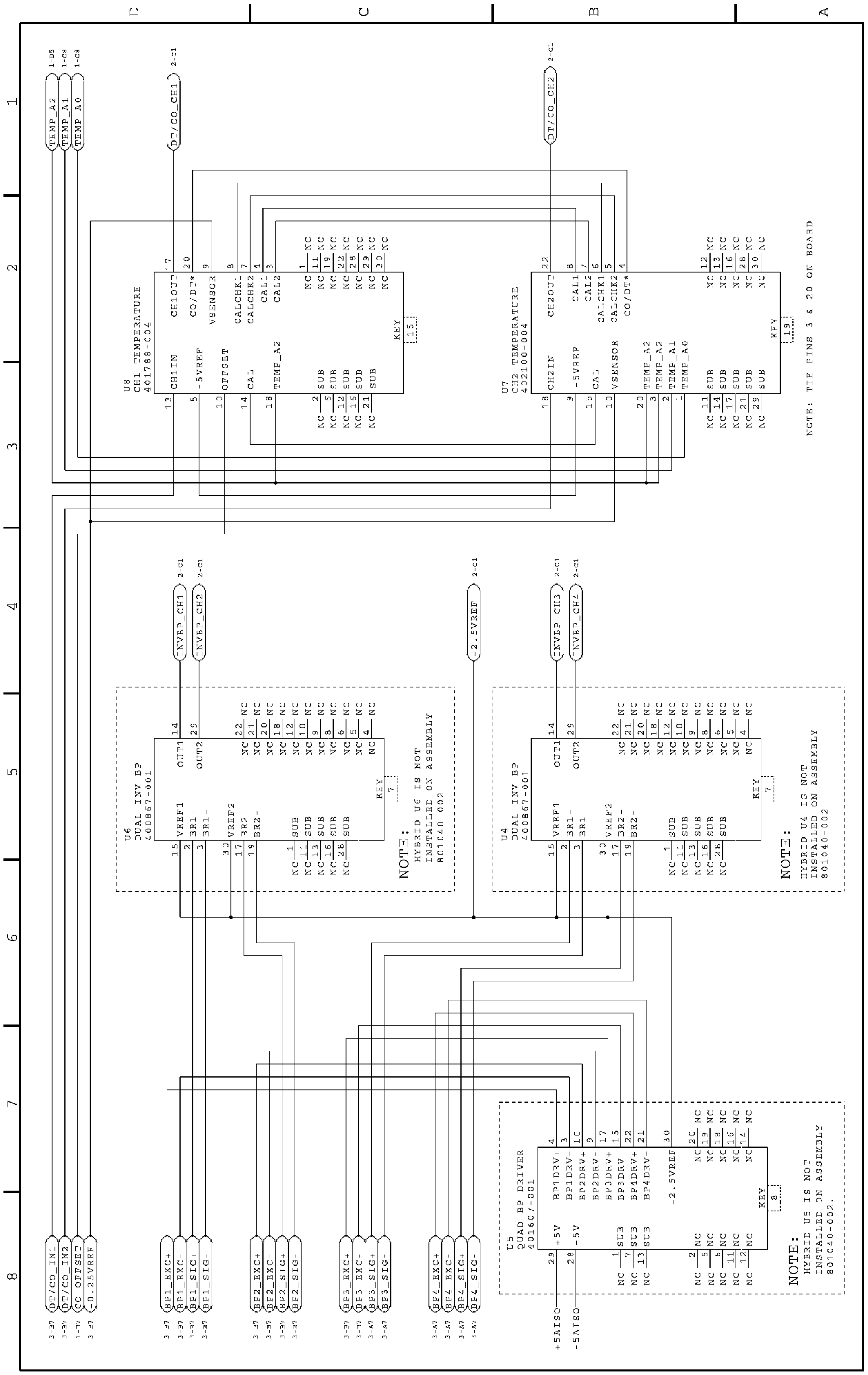
5 of 12


D
C
B
A
1
2
3
4
5
6
7
8
RESP
CAR_LEVEL
2-C1
2-C1
RESP_I*/II
CAR_ENBL*
RESP_CLK
1-C8
1-C8
7-C2
C6
10
35V 5%
+12AISO
-12AISO
P-SHIELD
U17
RESPIRATION
DEMODULATOR
400871-004
RA_CAR
LA_CAR
LL_CAR
+5VL
SELI/II
V/V1_CAR
V2_CAR
V3_CAR
V4_CAR
V5_CAR
V6_CAR
DCLK
DCLK
KEY
12
RESP
CLVL
CEXT1
CEXT2
+12
-12
SUB
NC
NC
SHIELD
SHIELD
+5ISO
U16
RESPIRATION CARRIER
400870-001
V/V1
V2
V3
V4
V5
V6
RESPCLK
CDIS
SELI/II
+12
+12
-12
-12
RACOUT
LACOUT
LLCOUT
DCLK
DCLK
NC
NC
NC
SUB
SUB
SHIELD
KEY
16
+12AISO
-12AISO
NOTES:
TIE PINS ON BOARD:
2-18-23,
6,19,25
NOTE: ASSEMBLY 801040-001 USES 414639-002 AND
ASSEMBLY 801040-002 USES 414639-001
U18
414639-XXX
ECG DEFIB PROTECTION
RD
RC
RA
LA
LL
V/V1
RL
V2
V3
V4
V5
V6
414639-002
C11
.47
20%
50V
ISO
R19
499K
1/8W
CR12
10MF2
CR13
10MF2
+12AISO
-12AISO
WHITE
BLACK
RED
BROWN
GREEN
YELLOW
TAN
BLUE
ORANGE
VIOLET
GRAY
F-SHIELD
ECG CONNECTOR
RA
LA
LL
V/V1
V2
V3
V4
V5
V6
5-D8
5-B8

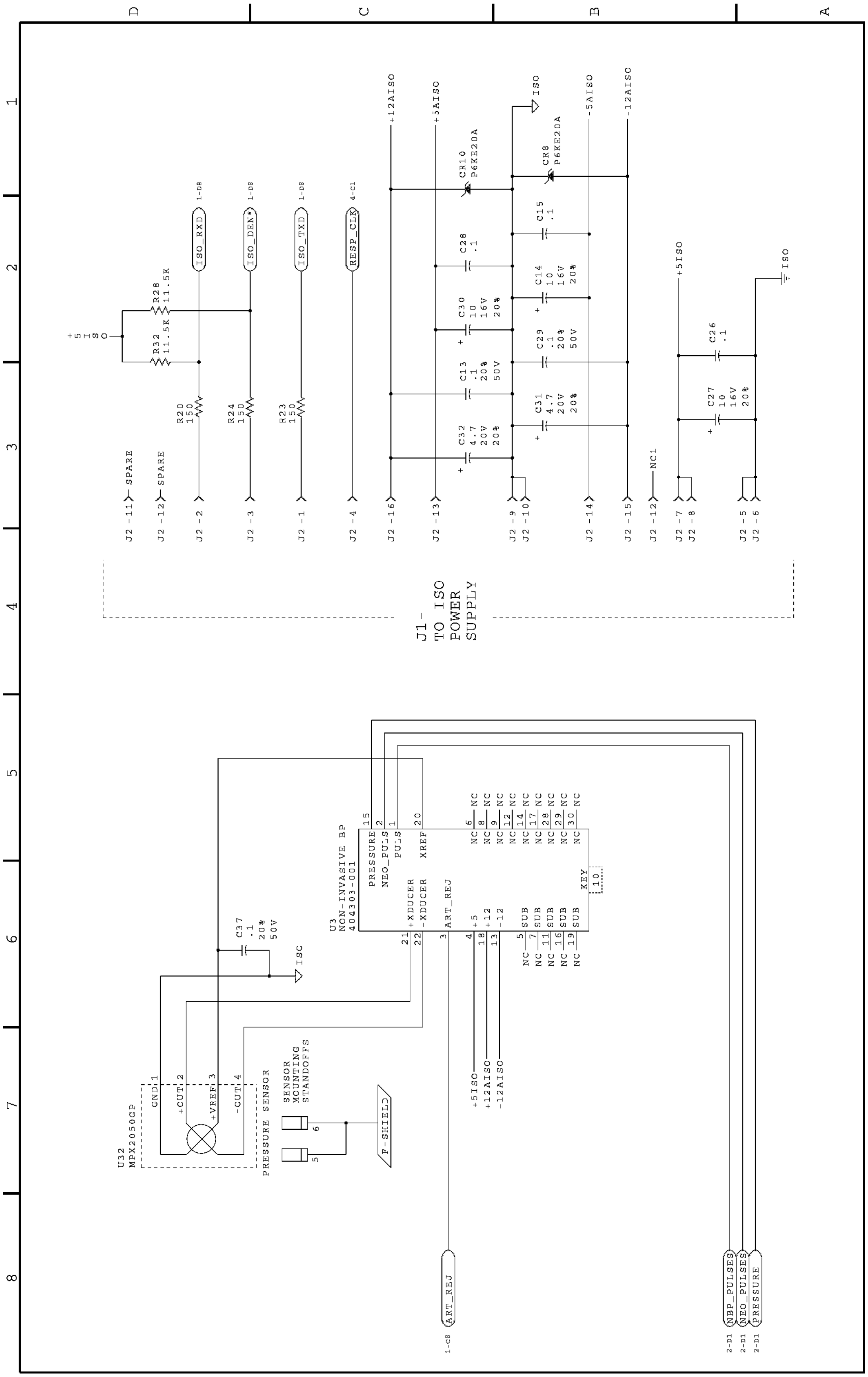
6 of 12


D
C
B
A
1
2
3
4
5
6
7
8
PACE_IRQ*
LEAD_I
LEAD_II
LEAD_III
LEAD_V/V1
V/V1_ATR
LEAD_V2
LEAD_V3
LEAD_V4
LEAD_V5
LEAD_V6
TRK*/HOLD
U10
ECG FINAL AMP
401787-001
U9
ECG FINAL AMP
401787-001
U12
PACE REJECT
401786-001
U11
PACE REJECT
401786-001
TRACK/HOLD
U13
PACE DETECT
800982-001
KEY
U15
ECG PRE-AMP
400869-004
U14
ECG PRE-AMP II
401790-001
BIAS_RA
BIAS_LA
BIAS_LL
BIAS_V/V1
BIAS_V2
BIAS_V3
BIAS_V4
BIAS_V5
BIAS_V6
F-SHIELD
RA
LA
LL
V/V1
REF_SEL1
REF_SEL0
+12AISO
-12AISO
MUX_PSEL3
MUX_PSEL2
MUX_PSEL1
MUX_PSEL0
V2
V3
V4
V5
V6
NOTE:
HYBRIDS U9, U11, AND U14 ARE NOT
INSTALLED ON 801040-002 ASSEMBLY.
NOTES:
PIN 27 IS +5V
ON OTHER HYBRIDS
TIE PINS ON BOARD:
13-28,
5-11-21-23,
6-10-20-25

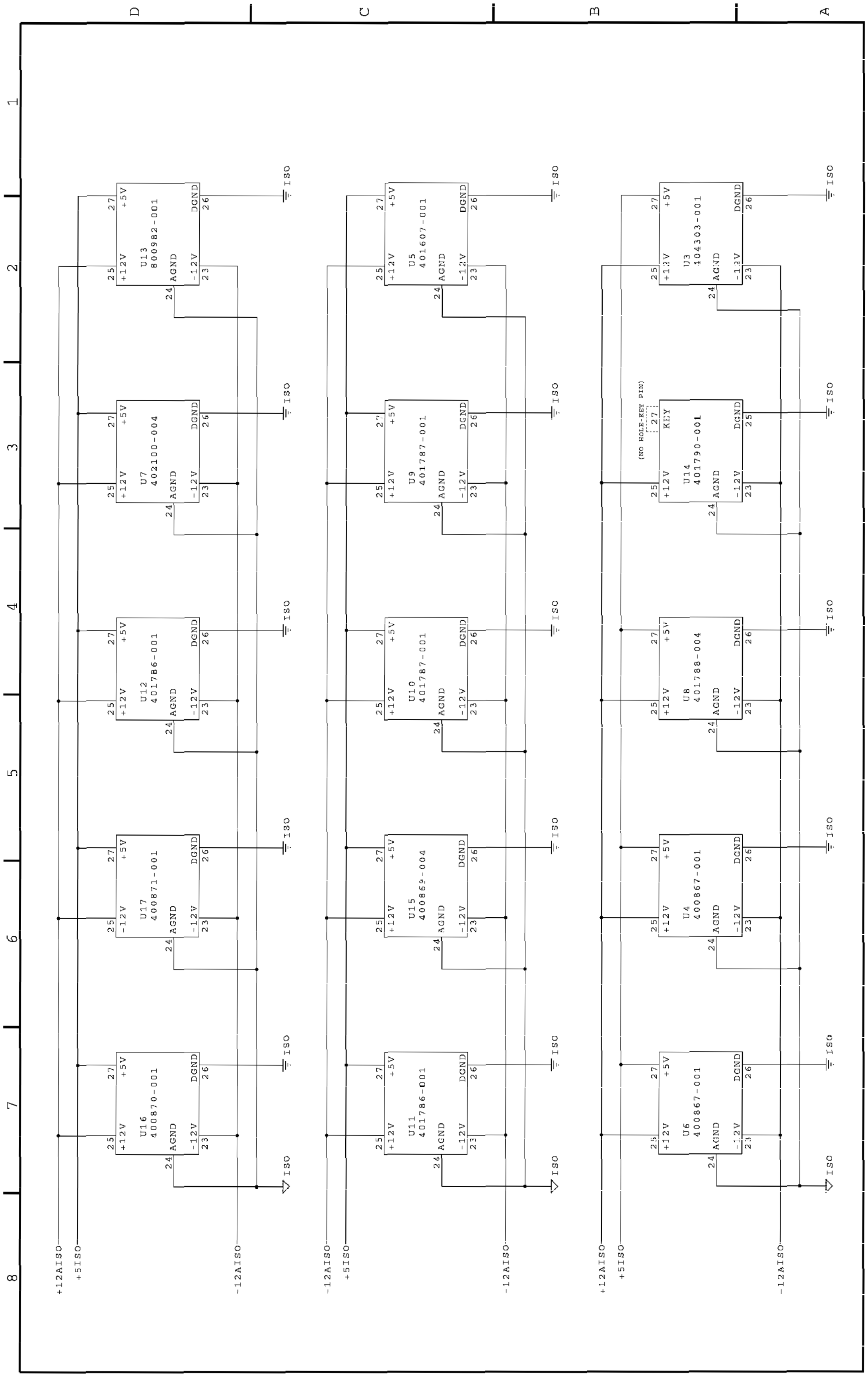
7 of 12


D
C
B
A
1
2
3
4
5
6
7
8
TEMP_A2
TEMP_A1
TEMP_A0
DT/CO_CH1
DT/CO_CH2
U8
CH1 TEMPERATURE
401788-004
CH1IN
-5VREF
OFFSET
CAL
TEMP_A2
CH1OUT
CO/DT*
VSENSOR
CALCHK1
CALCHK2
CAL1
CAL2
SUB
NC
KEY
15
U7
CH2 TEMPERATURE
402100-004
CH2IN
-5VREF
CAL
VSENSOR
TEMP_A2
TEMP_A1
TEMP_A0
CH2OUT
CAL1
CAL2
CALCHK1
CALCHK2
CO/DT*
KEY
19
NOTE: TIE PINS 3 & 20 ON BOARD
INVBP_CH1
INVBP_CH2
+2.5VREF
INVBP_CH3
INVBP_CH4
U6
DUAL INV BP
400867-001
VREF1
BR1+
BR1-
VREF2
BR2+
BR2-
OUT1
OUT2
KEY
7
NOTE:
HYBRID U6 IS NOT
INSTALLED ON ASSEMBLY
801040-002
U4
DUAL INV BP
400867-001
NOTE:
HYBRID U4 IS NOT
INSTALLED ON ASSEMBLY
801040-002
U5
QUAD BP DRIVER
401607-001
+5V
-5V
BP1DRV+
BP1DRV-
BP2DRV+
BP2DRV-
BP3DRV+
BP3DRV-
BP4DRV+
BP4DRV-
-2.5VREF
KEY
8
NOTE:
HYBRID U5 IS NOT
INSTALLED ON ASSEMBLY
801040-002.
+5AISO
-5AISO
DT/CO_IN1
DT/CO_IN2
CO_OFFSET
-0.25VREF
BP1_EXC+
BP1_EXC-
BP1_SIG+
BP1_SIG-
BP2_EXC+
BP2_EXC-
BP2_SIG+
BP2_SIG-
BP3_EXC+
BP3_EXC-
BP3_SIG+
BP3_SIG-
BP4_EXC+
BP4_EXC-
BP4_SIG+
BP4_SIG-

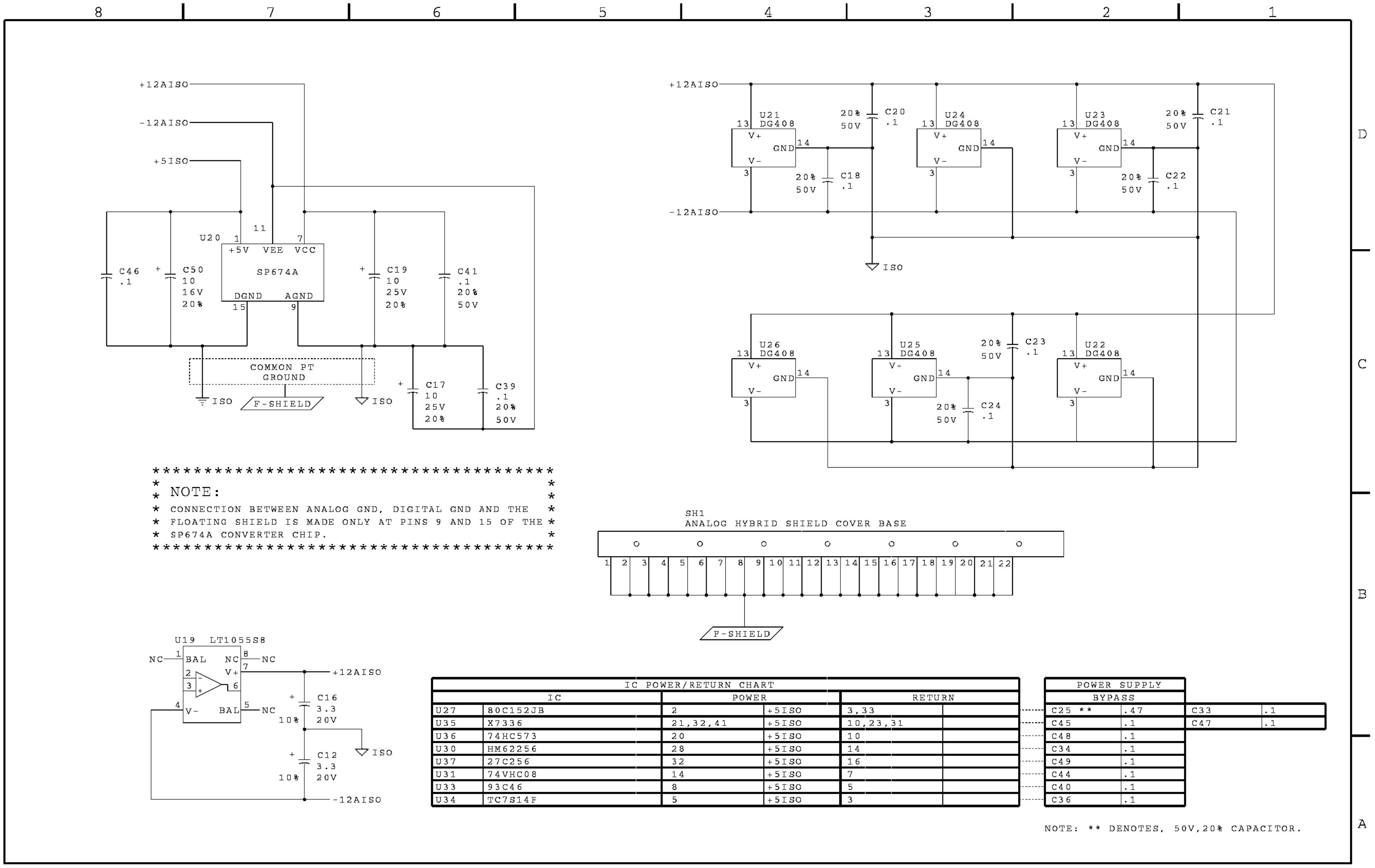
8 of 12


D
C
B
A
1
2
3
4
5
6
7
8
J1-
TO ISO
POWER
SUPPLY
J2 -11 SPARE
J2 -12 SPARE
J2 -2
J2 -3
J2 -1
J2 -4
J2 -16
J2 -13
J2 -9
J2 -10
J2 -14
J2 -15
J2 -12 NC1
J2 -7
J2 -8
J2 -5
J2 -6
+5ISO
R28 11.5K
R32 11.5K
R20 150
R24 150
R23 150
ISO_RXD 1-D8
ISO_DEN* 1-D8
ISO_TXD 1-D8
RESP_CLK 4-C1
+12AISO
+5AISO
ISO
-5AISO
-12AISO
CR10 P6KE20A
CR8 P6KE20A
C28 .1
C15 .1
C30 10 16V 20%
C14 10 16V 20%
C13 .1 20% 50V
C29 .1 20% 50V
C32 4.7 20V 20%
C31 4.7 20V 20%
+5ISO
C26 .1
C27 10 16V 20%
ISO
U3
NON-INVASIVE BP
404303-001
PRESSURE
NEO_PULS
PULS
XREF
+XDUCER
-XDUCER
ART_REJ
+5
+12
-12
SUB
NC
KEY
10
C37 .1 20% 50V
ISC
U32
MPX2050GP
PRESSURE SENSOR
GND 1
+OUT 2
+VREF 3
-OUT 4
SENSOR MOUNTING STANDOFFS
5
6
F-SHIELD
+5ISO
+12AISO
-12AISO
ART_REJ 1-C8
NBP_PULSES 2-D1
NEO_PULSES 2-D1
PRESSURE 2-D1

9 of 12


D
C
B
A
1
2
3
4
5
6
7
8
U13
800982-001
U7
402100-004
U12
401786-001
U17
400871-001
U16
400870-001
U5
401607-001
U9
401787-001
U10
401787-001
U15
400869-004
U11
401786-001
U3
404303-001
U14
401790-001
U8
401788-004
U4
400867-001
U6
400867-001
+12V
+5V
AGND
DGND
-12V
KEY
(NO HOLE-KEY PIN)
23
24
25
26
27
ISO
+12AISO
+5ISO
-12AISO

10 of 12


8
7
6
5
4
3
2
1
D
C
B
A
+12AISO
-12AISO
+5ISO
U20
SP674A
+5V VEE VCC
DGND AGND
1 11 7 15 9
C46 .1
C50 10 16V 20%
C19 10 25V 20%
C41 .1 20% 50V
C17 10 25V 20%
C39 .1 20% 50V
COMMON PT GROUND
ISO
F-SHIELD
U21 DG408
U24 DG408
U23 DG408
U26 DG408
U25 DG408
U22 DG408
V+ V- GND
13 3 14
C20 .1 20% 50V
C18 .1 20% 50V
C21 .1 20% 50V
C22 .1 20% 50V
C23 .1 20% 50V
C24 .1 20% 50V
SH1
ANALOG HYBRID SHIELD COVER BASE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
U19 LT1055S8
BAL NC V+ V- BAL
NC
C16 3.3 20V 10%
C12 3.3 20V 10%

****

* NOTE: *

* CONNECTION BETWEEN ANALOG GND, DIGITAL GND AND THE *
* FLOATING SHIELD IS MADE ONLY AT PINS 9 AND 15 OF THE *
* SP674A CONVERTER CHIP. *

****

IC POWER/RETURN CHART

IC		POWER		RETURN	
U27	80C152JB	2	+5ISO	3,33	
U35	X7336	21,32,41	+5ISO	10,23,31	
U36	74HC573	20	+5ISO	10	
U30	HM62256	28	+5ISO	14	
U37	27C256	32	+5ISO	16	
U31	74VHC08	14	+5ISO	7	
U33	93C46	8	+5ISO	5	
U34	TC7S14F	5	+5ISO	3	

POWER SUPPLY

BYPASS			
C25 **	.47	C33	.1
C45	.1	C47	.1
C48	.1		
C34	.1		
C49	.1		
C44	.1		
C40	.1		
C36	.1		

NOTE: ** DENOTES, 50V,20% CAPACITOR.

11 of 12

REFDES	PAGE COORDINATES
U1:	2-D5
U10:	6-B3 8-D3
U11:	6-D3 8-B5
U12:	5-C3 8-C3
U13:	5-D3 8-C5
U14:	5-C4 8-C7
U15:	5-D4 8-D5
U16:	5-D5 8-D2
U17:	5-C8 8-B3
U18:	5-D8 8-C6
U19:	4-B4 8-D7
U2:	3-B6
U20:	4-D3 8-D6
U21:	4-D8
U22:	2-C5 9-B8
U23:	2-B4 9-D4
U24:	2-D2 9-C2
U25:	2-C2 9-D2
U26:	2-D2 9-D3
U27:	2-B2 9-C3
U28:	2-B2 9-C4
U29:	1-D7 9-B5
U3:	3-B6
U30:	7-D7
U31:	3-D2 9-A5
U32:	2-C7 9-D7

REFDES	PAGE COORDINATES
U33:	1-D2 9-A5
U34:	1-B2
U35:	1-C5,D8 2-D6 9-A5
U36:	1-C4 9-A5
U37:	1-D4 9-B5
U38:	1-A8 9-B5
U39:	1-C3 9-A5
U4:	3-C7,D7 9-A5,B2,C2
U40:	2-D7 9-A5
U5:	3-C4,D4,D6
U6:	7-C6 8-B2
U7:	6-B5 8-B6
U8:	6-B8 8-C2
U9:	6-D5 8-B7

12 of 12

CONN	LABEL
J1-1:	07071024
J1-10:	ISOAGND
J1-13:	+5AISO
J1-14:	-5AISO
J1-15:	-12AISO
J1-16:	+12AISO
J1-2:	07071016
J1-3:	07071020
J1-4:	RESP_CLK
J1-5:	ISOGND
J1-6:	ISOGND
J1-7:	+5ISO
J1-8:	+5ISO
J1-9:	ISOAGND
J2-1:	ISOAGND
J2-10:	BP4_EXC-
J2-11:	FSHIELD
J2-12:	BP4_SIG+
J2-13:	FSHIELD
J2-14:	BP3_SIG+
J2-15:	BP2_SIG-
J2-16:	BP1_EXC-
J2-17:	03011027
J2-18:	BP1_SIG+
J2-19:	ISOGND
J2-2:	DT/CO_IN1
J2-20:	BP1_SIG-
J2-21:	ISOGND
J2-22:	BP3_EXC+
J2-23:	BP2_EXC-
J2-24:	BP2_SIG+
J2-25:	BP2_EXC+
J2-26:	BP3_EXC-
J2-27:	03011022
J2-28:	BP4_SIG-
J2-29:	03011007
J2-3:	ISOAGND
J2-30:	BP3_SIG-
J2-31:	03011017
J2-32:	BP1_EXC+
J2-33:	03011012
J2-34:	+0.25VREF
J2-4:	DT/CO_IN2
J2-5:	03011037
J2-6:	CO_OFFSET
J2-7:	03011032
J2-8:	BP4_EXC+
J3-1:	A/D_VCAL
J3-2:	ISOGND
J3-3:	03043042
J3-4:	ISOAGND

Assembly Configurations PN 800330

An older acquisition processor PCB was manufactured with ten configurations. The differences between assemblies are:

- how many blood pressures channels they monitor, and
- how many ECG leadwires they use, and
- whether or not they support noninvasive blood pressure monitoring.

The table below lists the available configurations.

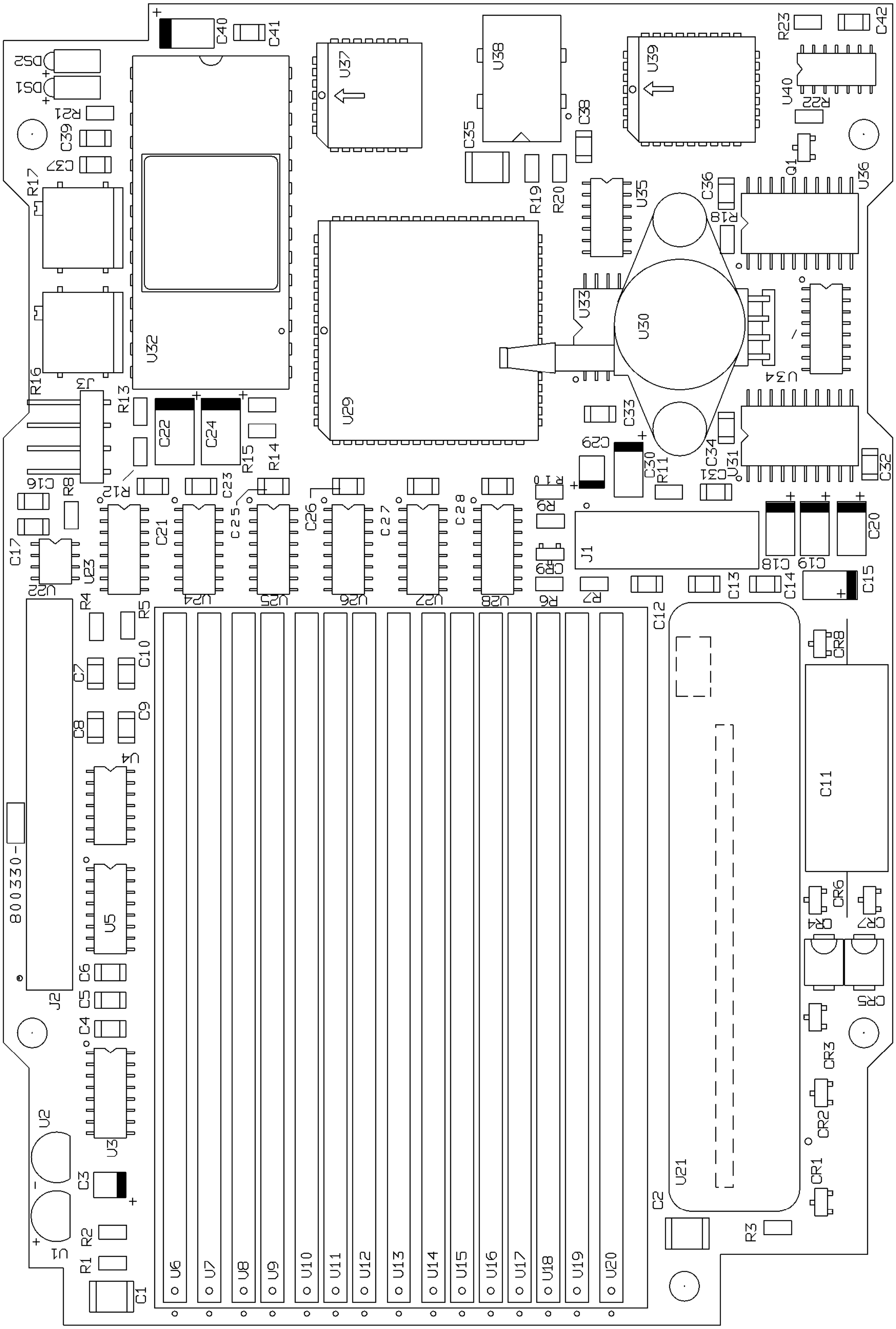
Table 29-2. Configurations

Part Number	Rev	Pressures	ECG Leadwires	NBP
800330-002	E	4	5	No
800330-004	B	4	10	No
800330-005	E	2	5	Yes
800330-006	B	2	10	Yes
800330-007	B	4	10	Yes
800330-008	B	4	5	Yes
800330-009	D	3	5	Yes
800330-010	E	3	10	Yes
800330-011	B	0	5	Yes
800330-012	B	0	10	Yes

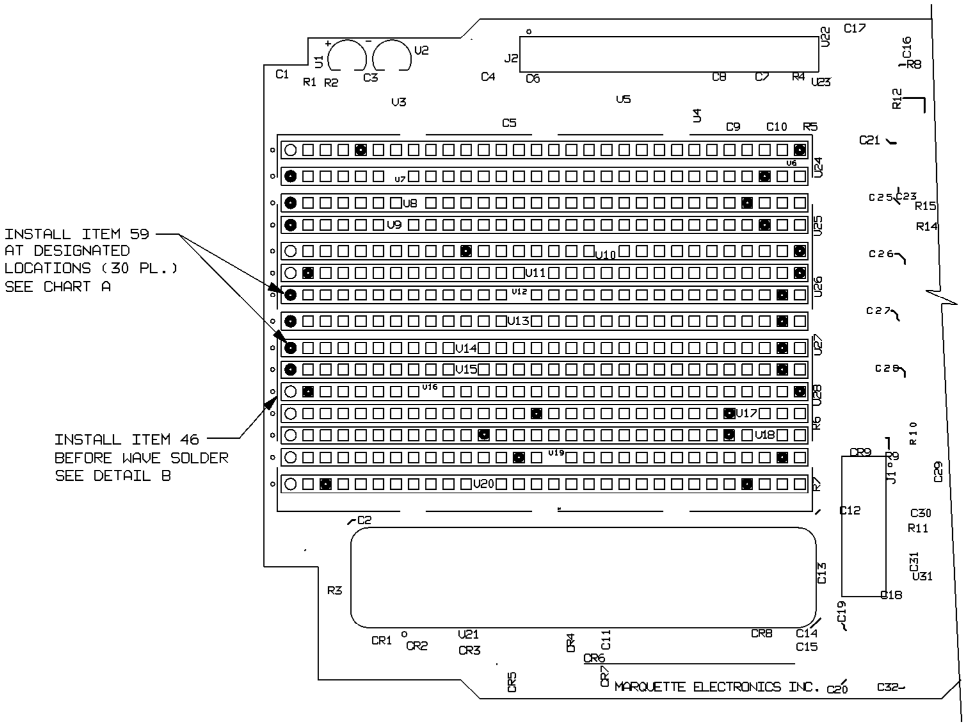
Note that part number 800330 without a dashed suffix (ie, pn 800330, as opposed to pn 800330-001 or pn 800330-002) refers to all of the assemblies listed in the table above. Unless otherwise noted, all assemblies are the same.

Parts Location Diagram PN 800330B

1 of 2


C40
C41
U37
U38
U39
R23
C42
DS2
DS1
R21
C39
C37
U40
R22
C38
C35
Q1
R19
R20
U35
C36
R18
U36
R17
U32
U29
U33
U30
U34
R16
J3
R13
C22
C24
R15
R14
C33
C29
C34
C30
R11
C31
U31
C32
C16
R8
R12
C23
R10
C21
C25
C26
C27
C28
R9
J1
C18
C19
C20
C17
U23
CR9
U22
R4
R5
U24
U25
U26
U27
U28
R6
R7
C13
C14
C15
C12
CR8
C7
C10
C8
C9
U4
C11
800330-
U5
CR6
CR4
CR7
C6
C5
CR5
J2
C4
CR3
U2
U3
CR2
C3
U21
CR1
C2
U1
R2
R3
R1
C1
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
U18
U19
U20

2 of 2

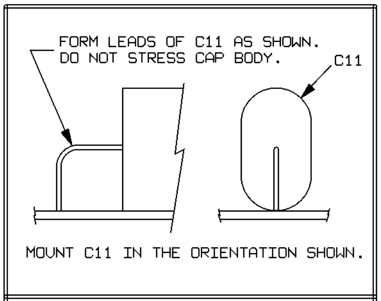

U1
U2
C1
R1
R2
C3
C4
J2
C6
C8
C7
R4
U23
U22
C17
C16
R8
R12
U3
U5
U4
C9
C10
R5
C5
C21
U6
U24
U7
U8
C25
C23
R15
R14
U9
U25
U10
C26
U11
U12
U26
C27
U13
U14
U27
C28
U15
U16
U28
U17
R6
R10
U18
CR9
J1
C29
U19
U20
R7
C2
C12
C30
R11
C13
C31
U31
C18
R3
C19
CR8
C14
C15
CR1
CR2
U21
CR3
CR4
C11
CR6
CR7
CR5
MARQUETTE ELECTRONICS INC.
C20
C32

INSTALL ITEM 59
AT DESIGNATED
LOCATIONS (30 PL.)
SEE CHART A

INSTALL ITEM 46
BEFORE WAVE SOLDER
SEE DETAIL B

CHART A	
U6	5,30
U7	1,28
U8	1,27
U9	1,28
U10	11,30
U11	2,30
U12	1,29
U13	1,29
U14	1,29
U15	1,29
U16	2,30
U17	15,26
U18	12,26
U19	14,29
U20	3,27

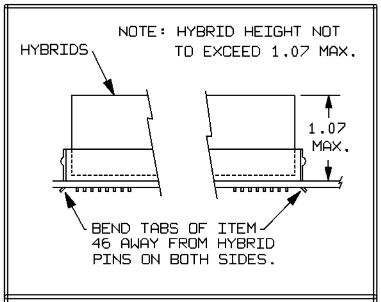
SOCKET PIN LOCATIONS



FORM LEADS OF C11 AS SHOWN.
DO NOT STRESS CAP BODY.

MOUNT C11 IN THE ORIENTATION SHOWN.

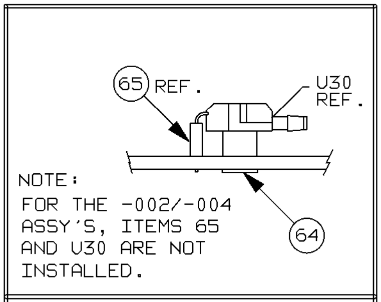
DETAIL A


HYBRIDS
1.07
MAX.

NOTE: HYBRID HEIGHT NOT
TO EXCEED 1.07 MAX.

BEND TABS OF ITEM
46 AWAY FROM HYBRID
PINS ON BOTH SIDES.

DETAIL B


65 REF.
U30
REF.
64

NOTE:
FOR THE -002/-004
ASSY'S, ITEMS 65
AND U30 ARE NOT
INSTALLED.

DETAIL C

Parts List PN 800330B

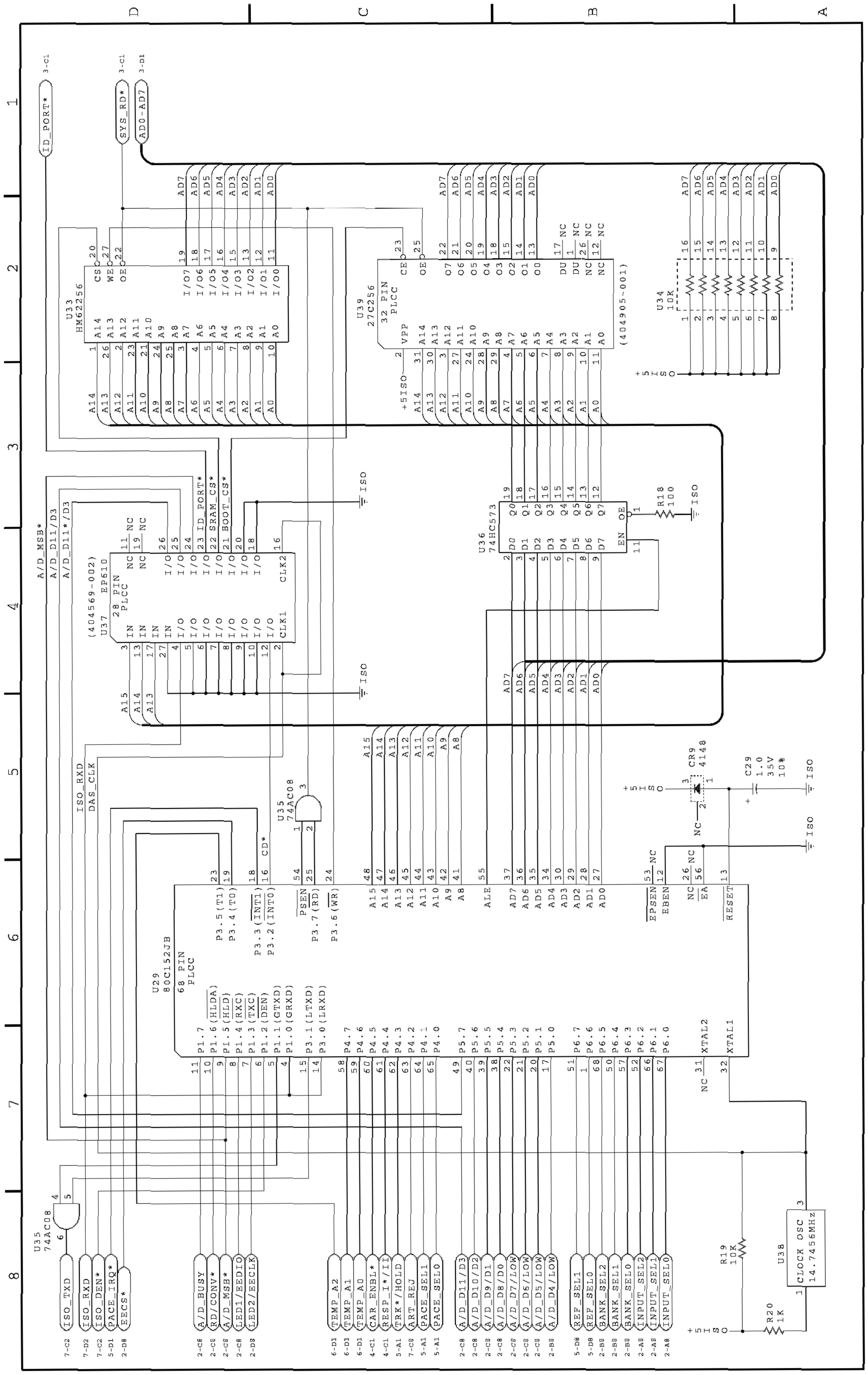
Item	Parts List	Part Number	Qty
C1, 2, 35	Cap, Cer, 0.47µF, 20%	1187-474	3
C3, 29	Cap, Tant, 1.0µF, 10%, 35V, SM	403907-001	2
C4-10, 12, 13, 14, 16, 17, 21, 23, 25, 26, 27, 28, 31-34, 36-39, 41, 42	Cap, Cer, 0.1µF, 20%, 50V	404370-001	28
C11	Cap, MPE, 10µF, 5%, 35V	1215-106	1
C15, 18, 30, 40	Cap, Tant, 10µF, 20%, 10V, SM	1176-106	4
C19, 20	Cap, Tant, 4.7µF, 20%, 20V, SM	402004-001	2
C22, 24	Cap, Tant, 10µF, 20%, 25V, SM	1152-106	2
CR1	Diode, SM FDSO1503	2414-001	1
CR2, 3, 6, 7, 8	Diode, SM (Not Used on PN 800330-004, -006, -007, -010, and -012)	2414-001	5
CR4, 5	Transorb, 15V, 5%, 600W SM6T15A	403188-001	2
CR9	Diode, SM MMAD4148	401980-001	1
DS1, 2	Diode, Light-Emitting (Red)	2498-002	2
J1	Connector, Vertical, 16-Pin	1847-016	1
J2	Connector, PC Header, 34-Pin, Vertical	1778-234	1
J3	PC Post, Right Angle	1778-436	4
Q1	Transistor, PNP, SM T3906	2511-101	1
R1, 18	Res, Cer, 100Ω, 1%, 1/8W, SM	1082-755	2
R2	Res, Cer, 243K, 1%, 1/8W, SM	1082-798	1
R3	Res, Cer, 499K, 1%, 1/8W, SM	1082-499	1
R4, 5, 8, 9, 20, 23	Res, Cer, 1K, 1%, 1/8W, SM	1082-103	6
R6, 7, 10, 11	Res, Cer, 150Ω, 1%, 1/8W, SM	1082-767	4
R12	Res, Cer, 47.5K, 1%, 1/8W, SM	1082-757	1
R13	Res, Cer, 2K, 1%, 1/8W, SM	1082-201	1
R14, 15, 19, 21, 22	Res, Cer, 10K, 1%, 1/8W, SM	1082-104	5
R16, 17	Res, Var, 100Ω, 12-Turn, Side-Adjust	403407-001	2
SH1	Shield, Hybrids	403284-001	1
U1	Sensor, Temperature, TO92 LM35CZ	403396-001	1
U2	Volt Rgltr, +5V, 0.5%, 100mA, TO92 LP2950	402581-001	1
U3, 34	Res Ntwk, 10K	1062-103	2
U4	Diode Array, SM MMAD130	403957-001	1
U5	Res Ntwk, 1K	1062-102	1
U6	Hybrid, NBP (Not Used on PN 800330-002 or -004)	404303-001	1
U7	Hybrid, Dual Invasive BP Amplifier (Not Used on PN 800330-005, -006, -011, -012)	400867-001	1
U8	Hybrid, Quad Invasive BP Driver (Not Used on PN 800330-011, -012)	401607-001	1
U9	Hybrid, Dual Invasive BP Amplifier (Not Used on PN 800330-011, -012)	400867-001	1
U10	Hybrid, TEMP, Channel 2	402100-004	1

Item	Parts List	Part Number	Qty
U11	Hybrid, TEMP, Channel 1	401788-004	1
U12	Hybrid, ECG Final Amplifier (Not Used on PN 800330-002, -005, -008, -009, -011)	401787-001	1
U13	Hybrid, ECG Final Amplifier	401787-001	1
U14	Hybrid, ECG Pacemaker Rejection (Not Used on PN 800330-002, -005, -008, -009, -011)	401786-001	1
U15	Hybrid, ECG Pacemaker Rejection	401786-001	1
U16	Hybrid, ECG Pacemaker Detection	401785-001	1
U17	Hybrid, ECG Preamplifier II (Not Used on PN 800330-002, -005, -008, -009, -011)	401790-001	1
U18	Hybrid, ECG Preamplifier	400869-004	1
U19	Hybrid, RESP Carrier	400870-001	1
U20	Hybrid, RESP Demodulator	400871-004	1
U21	ECG Surge Protection Module	403993-001	1
U22	Operational Ampl, JFET, SM LT1055	402396-001	1
U23-28	Analog Multiplexer, 4-Channel, Dual, SM DG408DY/508DY	402024-001	6
U29	Microcontroller, Programmed, Communication Control, PLCC 80C152JB	400368-001	1
U30	Sensor, Pressure, 7.3PSI, Compensated (Not Installed on 800330-002 and -004)	404406-003	1
U31	Buffer/Driver, Octal, SM HC541	401974-001	1
U32	ADC, 12-Bit, Custom	405548-001	1
U33	RAM, Static, 32K x 8-Bit, SM 62256FLP	3202-256	1
U35	AND Gate, 2-Input, Quad, SM AC08	402717-001	1
U36	Latch, Transparent, Three-State Output, Octal, SM HC573	401971-001	1
U37	EPLD, Programmed, Acquisition Processor, PLCC	404569-002	1
U38	Oscillator, CMOS, 14.7456MHz, SM	401480-001	1
U39	EPROM, Programmed, Acquisition Processor Boot Code, PLCC	404905-001	1
U40	EEPROM, Serial NMC93C06	402577-001	1
-	Socket Hybrids	403283-002	1
-	Socket, 4-Pin (for U30) (Not Installed on PN 800330-002 and -004)	404939-001	1
-	Socket, Mini (for U6-U20)	1818-201	30
-	Spacer Strip, 36-Position (for U30) (Not Installed on PN 800330-002 or -004)	405598-001	AR
-	Spacer, Round, 6-32 x 1/4 (for U30) (Not Installed on PN 800330-002 and -004)	4663-604	1
-	Circuit Board	800331-001B	1
-	Schematic Diagram	SD800330-001B	–

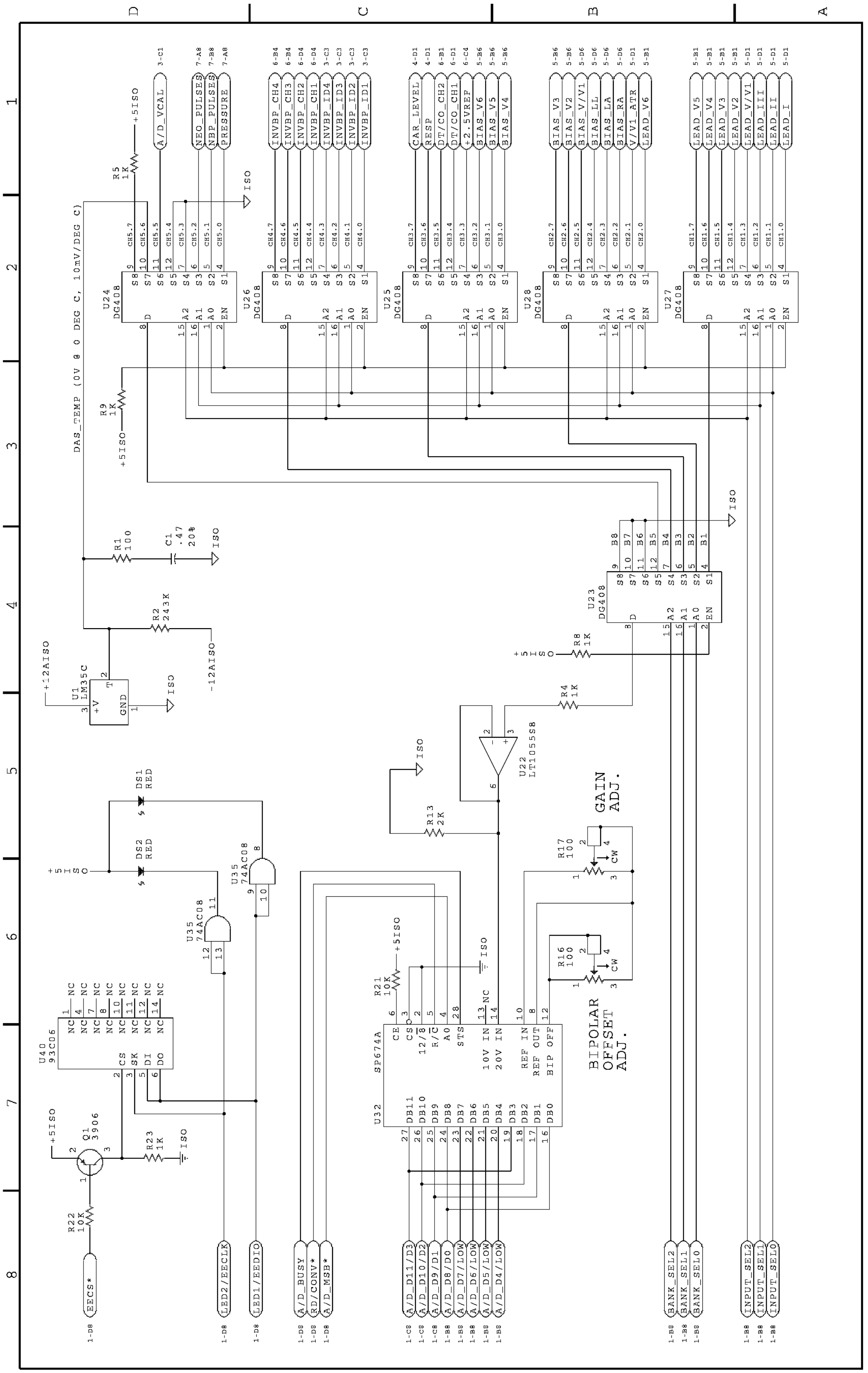
Schematic Diagram

PN SD800330-001B

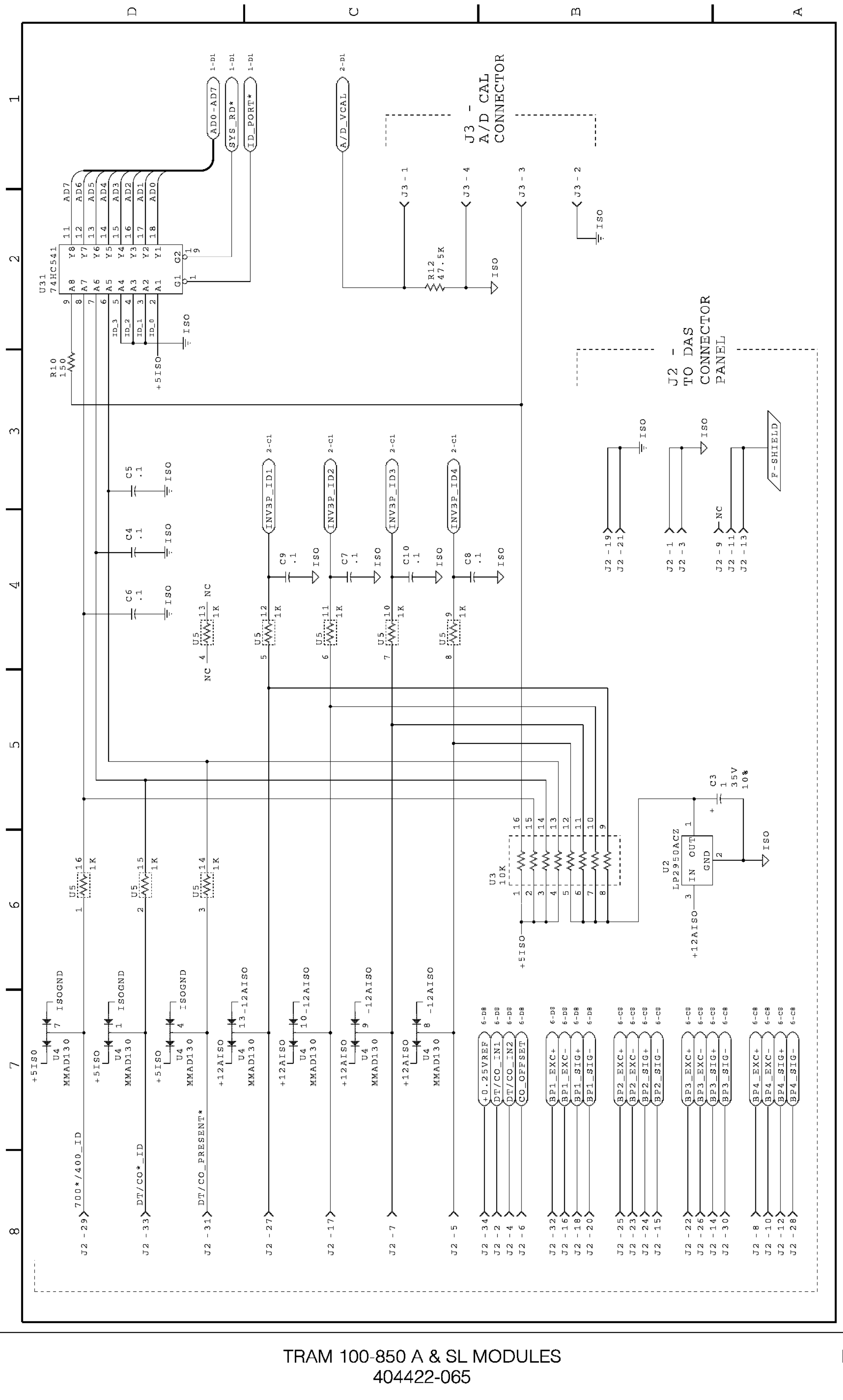
1 of 11


D
C
B
A
1
2
3
4
5
6
7
8
ID_PORT*
SYS_RD*
AD0-AD7
U33
HM62256
U39
27C256
32 PIN
PLCC
(404905-001)
U34
10K
+5ISO
U37
EP610
28 PIN
PLCC
(404569-002)
A/D_MSB*
A/D_D11/D3
A/D_D11*/D3
ID_PORT*
SRAM_CS*
BOOT_CS*
ISO
U36
74HC573
R18
100
ISO_RXD
DAS_CLK
U35
74AC08
CD*
CR9
4148
C29
1.0
35V
10%
U29
80C152JB
68 PIN
PLCC
P3.5(T1)
P3.4(T0)
P3.3(INT1)
P3.2(INT0)
PSEN
P3.7(RD)
P3.6(WR)
ALE
EPSEN
EBEN
EA
RESET
XTAL2
XTAL1
NC
R19
10K
R20
1K
U38
CLOCK OSC
14.7456MHz
ISO_TXD
ISO_RXD
ISO_DEN*
PACE_IRQ*
EECS*
A/D_BUSY
RD/CONV*
A/D_MSB*
LED1/EEDIO
LED2/EECLK
TEMP_A2
TEMP_A1
TEMP_A0
CAR_ENBL*
RESP_I*/II
TRK*/HOLD
ART_REJ
PACE_SEL1
PACE_SEL0
A/D_D11/D3
A/D_D10/D2
A/D_D9/D1
A/D_D8/D0
A/D_D7/LOW
A/D_D6/LOW
A/D_D5/LOW
A/D_D4/LOW
REF_SEL1
REF_SEL0
BANK_SEL2
BANK_SEL1
BANK_SEL0
INPUT_SEL2
INPUT_SEL1
INPUT_SEL0

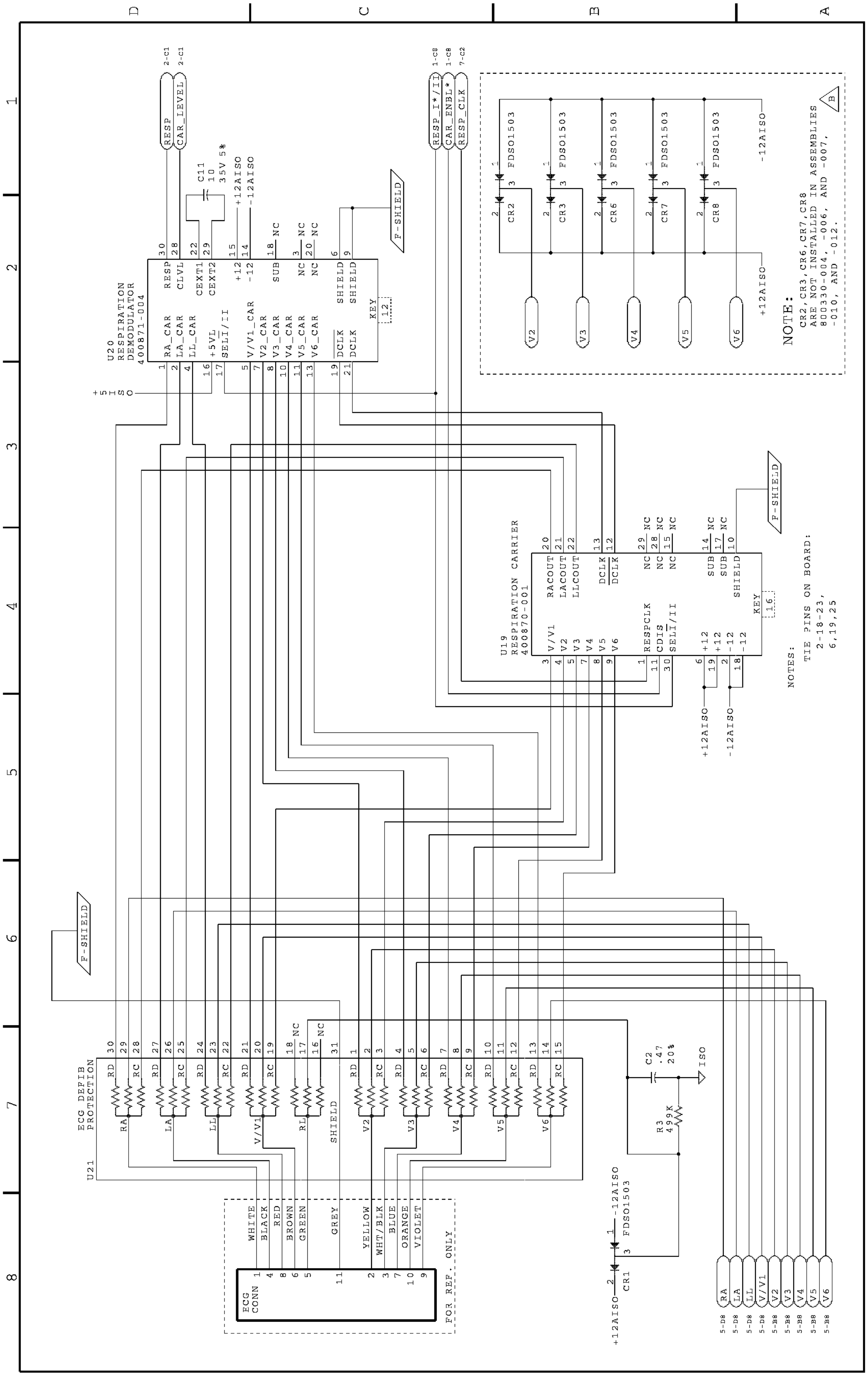
2 of 11


D
C
B
A
1
2
3
4
5
6
7
8
A/D_VCAL
NEO_PULSES
NBP_PULSES
PRESSURE
INVBP_CH4
INVBP_CH3
INVBP_CH2
INVBP_CH1
INVBP_ID4
INVBP_ID3
INVBP_ID2
INVBP_ID1
CAR_LEVEL
RESP
DT/CO_CH2
DT/CO_CH1
+2.5VREF
BIAS_V6
BIAS_V5
BIAS_V4
BIAS_V3
BIAS_V2
BIAS_V/V1
BIAS_LL
BIAS_LA
BIAS_RA
V/V1_ATR
LEAD_V6
LEAD_V5
LEAD_V4
LEAD_V3
LEAD_V2
LEAD_V/V1
LEAD_III
LEAD_II
LEAD_I
U24 DG408
U26 DG408
U25 DG408
U28 DG408
U27 DG408
U23 DG408
R5 1K
+5ISO
ISO
DAS_TEMP (0V @ 0 DEG C, 10mV/DEG C)
R9 1K
R1 100
C1 .47 20%
R2 243K
-12AISO
+12AISO
U1 LM35C
R8 1K
R4 1K
U22 LT1055S8
R13 2K
GAIN ADJ.
R17 100
R16 100
CW
BIPOLAR OFFSET ADJ.
DS1 RED
DS2 RED
U35 74AC08
U40 93C06
U32 SP674A
R21 10K
Q1 3906
R23 1K
R22 10K
EECS*
LED2/EECLK
LED1/EEDIO
A/D_BUSY
RD/CONV*
A/D_MSB*
A/D_D11/D3
A/D_D10/D2
A/D_D9/D1
A/D_D8/D0
A/D_D7/LOW
A/D_D6/LOW
A/D_D5/LOW
A/D_D4/LOW
BANK_SEL2
BANK_SEL1
BANK_SEL0
INPUT_SEL2
INPUT_SEL1
INPUT_SEL0

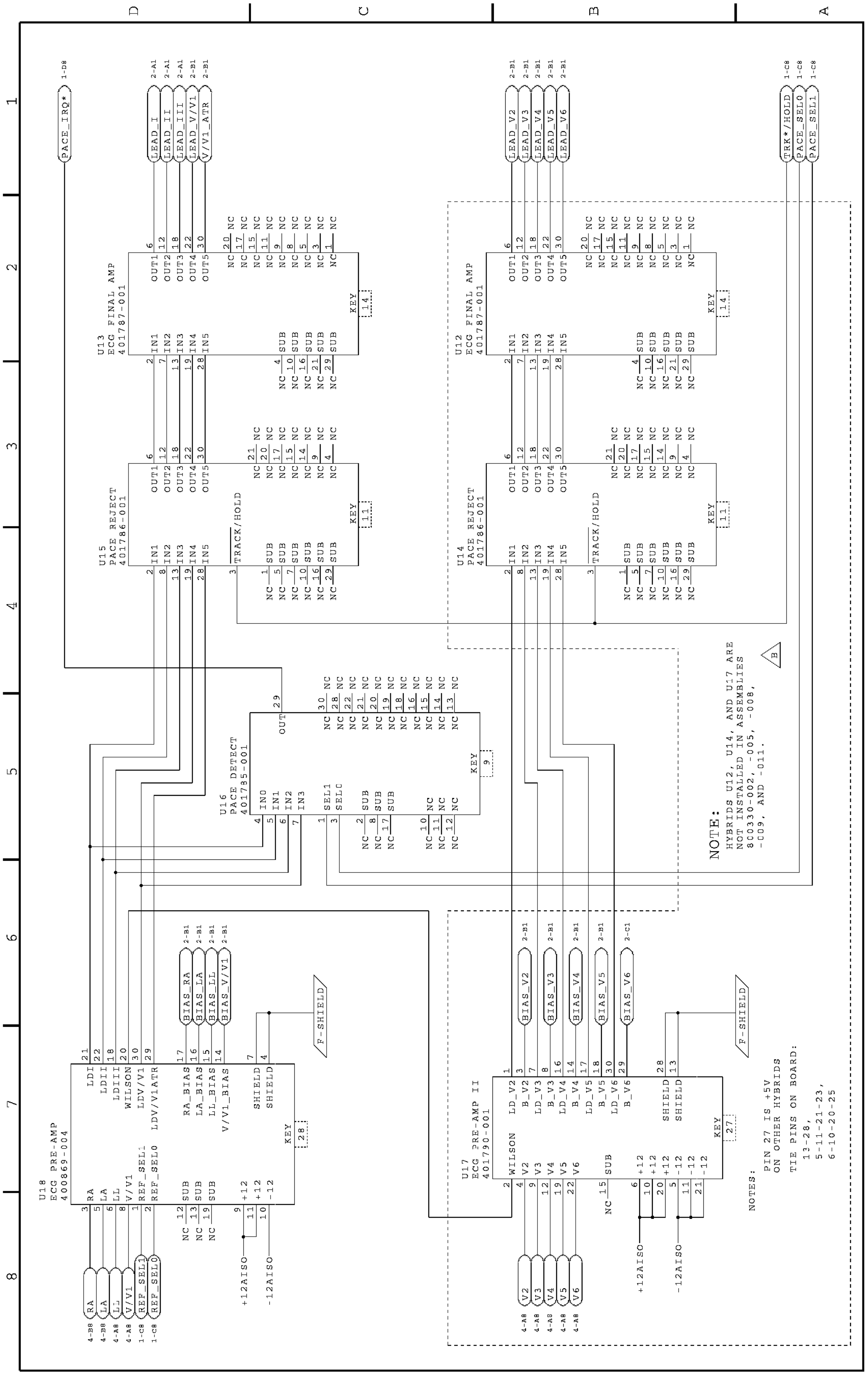
3 of 11


J3 - A/D CAL CONNECTOR
J2 - TO DAS CONNECTOR PANEL
U31 74HC541
AD0-AD7
SYS_RD*
ID_PORT*
A/D_VCAL
R12 47.5K
R10 150
+5ISO
ISO
C5 .1
C4 .1
C6 .1
C9 .1
C7 .1
C10 .1
C8 .1
INV3P_ID1
INV3P_ID2
INV3P_ID3
INV3P_ID4
U5 1K
NC
F-SHIELD
U3 10K
U2 LP2950ACZ
C3 1 35V 10%
+12AISO
U4 MMAD130
ISOGND
-12AISO
700*/400_ID
DT/CO*_ID
DT/CO_PRESENT*
+0.25VREF
DT/CO_IN1
DT/CO_IN2
CO_OFFSET
BP1_EXC+
BP1_EXC-
BP1_SIG+
BP1_SIG-
BP2_EXC+
BP2_EXC-
BP2_SIG+
BP2_SIG-
BP3_EXC+
BP3_EXC-
BP3_SIG+
BP3_SIG-
BP4_EXC+
BP4_EXC-
BP4_SIG+
BP4_SIG-
J2-29
J2-33
J2-31
J2-27
J2-17
J2-7
J2-5
J3-1
J3-4
J3-3
J3-2
D
C
B
A
1
2
3
4
5
6
7
8

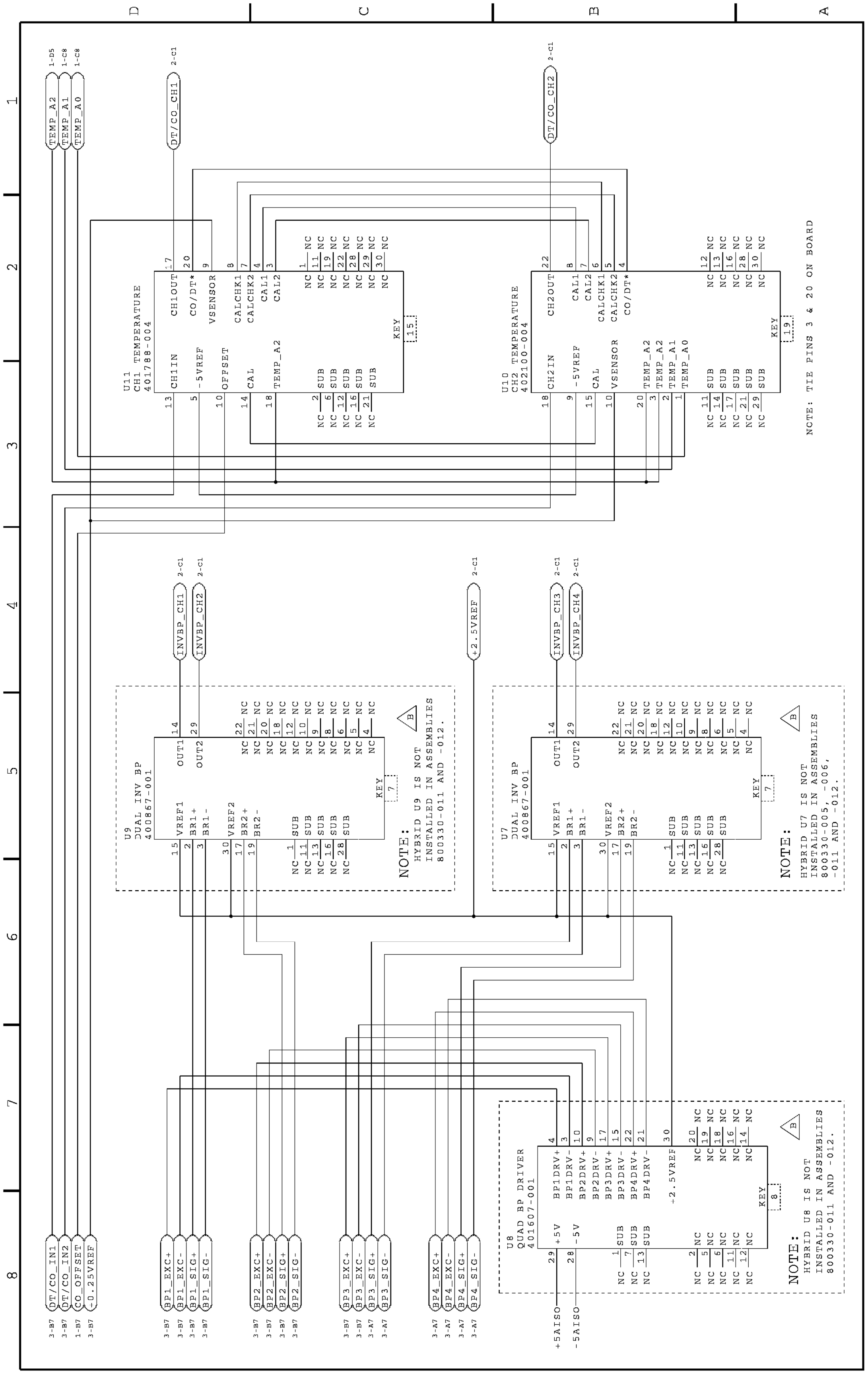
4 of 11


U20
RESPIRATION
DEMODULATOR
400871-004
RA_CAR
LA_CAR
LL_CAR
+5VL
SELI/II
V/V1_CAR
V2_CAR
V3_CAR
V4_CAR
V5_CAR
V6_CAR
DCLK
DCLK
RESP
CLVL
CEXT1
CEXT2
+12
-12
SUB
NC
NC
SHIELD
SHIELD
KEY
12
C11
10
35V 5%
+12AISO
-12AISO
RESP
CAR_LEVEL
2-C1
RESP_I*/II
CAR_ENBL*
RESP_CLK
1-C8
7-C2
F-SHIELD
+5ISO
CR2
CR3
CR6
CR7
CR8
FDSO1503
-12AISO
+12AISO
V2
V3
V4
V5
V6
NOTE:
CR2,CR3,CR6,CR7,CR8
ARE NOT INSTALLED IN ASSEMBLIES
800330-004, -006, AND -007,
-010, AND -012.
B
U19
RESPIRATION CARRIER
400870-001
V/V1
V2
V3
V4
V5
V6
RACOUT
LACOUT
LLCOUT
DCLK
DCLK
RESPCLK
CDIS
SELI/II
NC
SUB
SUB
SHIELD
KEY
16
+12
+12
-12
-12
NOTES:
TIE PINS ON BOARD:
2-18-23,
6,19,25
U21
ECG DEFIB
PROTECTION
RA
LA
LL
V/V1
RL
SHIELD
V2
V3
V4
V5
V6
RD
RC
C2
.47
20%
ISO
R3
499K
CR1
FDSO1503
+12AISO
-12AISO
WHITE
BLACK
RED
BROWN
GREEN
GREY
YELLOW
WHT/BLK
BLUE
ORANGE
VIOLET
ECG
CONN
FOR REF. ONLY
5-D8
5-B8
A
B
C
D
1
2
3
4
5
6
7
8

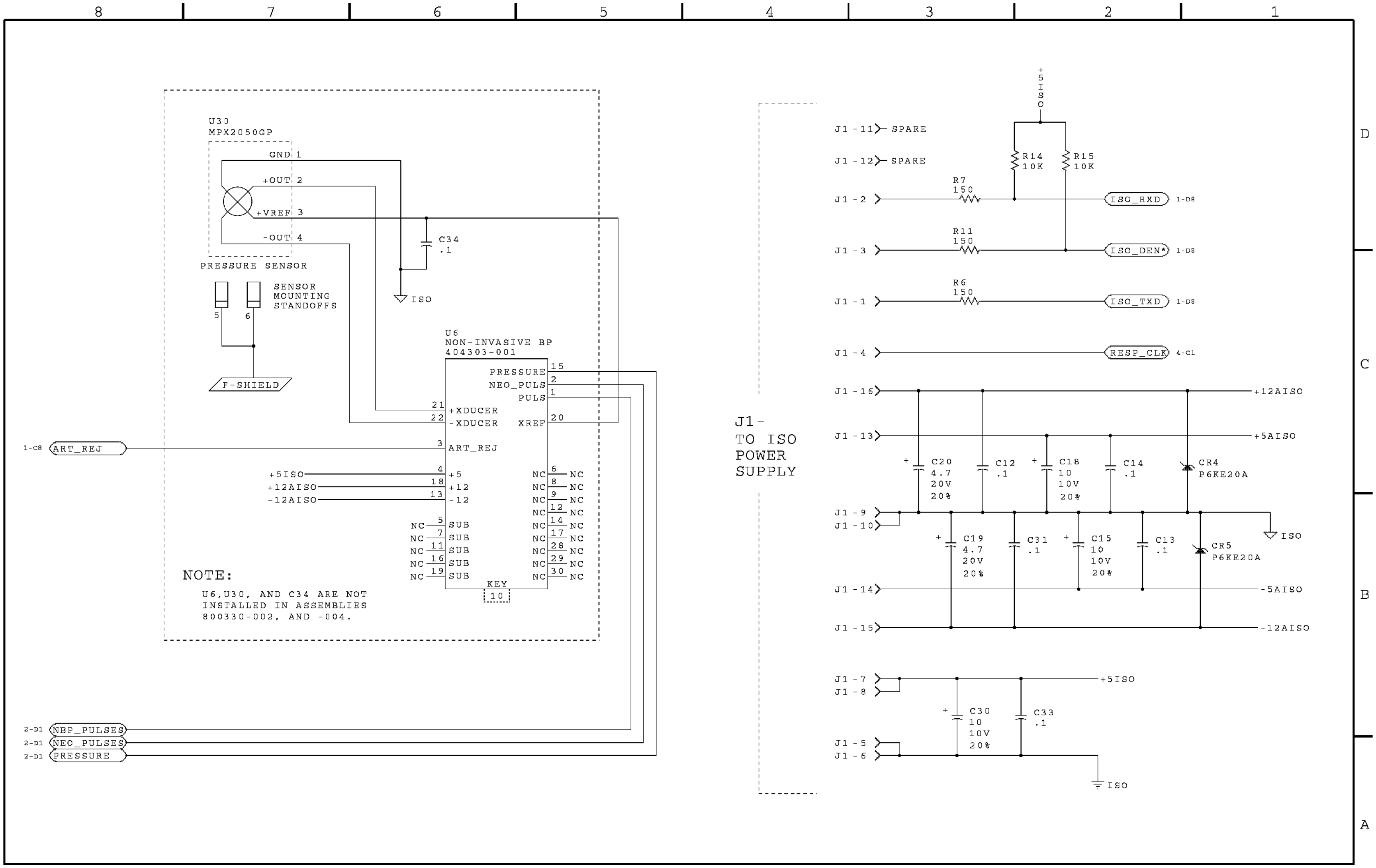
5 of 11


D
C
B
A
1
2
3
4
5
6
7
8
PACE_IRQ* 1-D8
LEAD_I 2-A1
LEAD_II 2-A1
LEAD_III 2-A1
LEAD_V/V1 2-B1
V/V1_ATR 2-B1
LEAD_V2 2-B1
LEAD_V3 2-B1
LEAD_V4 2-B1
LEAD_V5 2-B1
LEAD_V6 2-B1
TRK*/HOLD 1-C8
PACE_SEL0 1-C8
PACE_SEL1 1-C8
U13
ECG FINAL AMP
401787-001
U12
ECG FINAL AMP
401787-001
U15
PACE REJECT
401786-001
U14
PACE REJECT
401786-001
TRACK/HOLD
KEY 14
KEY 11
U16
PACE DETECT
401785-001
OUT
IN0
IN1
IN2
IN3
SEL1
SEL0
KEY 9
NOTE:
HYBRIDS U12, U14, AND U17 ARE
NOT INSTALLED IN ASSEMBLIES
8C0330-002, -005, -008,
-C09, AND -011.
B
U18
ECG PRE-AMP
400869-004
RA
LA
LL
V/V1
REF_SEL1
REF_SEL0
LDI
LDII
LDIII
WILSON
LLV/V1
LDV/V1ATR
RA_BIAS
LA_BIAS
LL_BIAS
V/V1_BIAS
SHIELD
KEY 28
BIAS_RA 2-B1
BIAS_LA 2-B1
BIAS_LL 2-B1
BIAS_V/V1 2-B1
F-SHIELD
+12AISO
-12AISO
RA 4-B8
LA 4-B8
LL 4-A8
V/V1 4-A8
REF_SEL1 1-C8
REF_SEL0 1-C8
U17
ECG PRE-AMP II
401790-001
WILSON
LD_V2
B_V2
LD_V3
B_V3
LD_V4
B_V4
LD_V5
B_V5
LD_V6
B_V6
KEY 27
BIAS_V2 2-B1
BIAS_V3 2-B1
BIAS_V4 2-B1
BIAS_V5 2-B1
BIAS_V6 2-C1
V2 4-A8
V3 4-A8
V4 4-A8
V5 4-A8
V6 4-A8
NOTES:
PIN 27 IS +5V
ON OTHER HYBRIDS
TIE PINS ON BOARD:
13-28,
5-11-21-23,
6-10-20-25

6 of 11


U11
CH1 TEMPERATURE
401788-004
CH1OUT
CO/DT*
VSENSOR
CALCHK1
CALCHK2
CAL1
CAL2
CH1IN
-5VREF
OFFSET
CAL
TEMP_A2
KEY 15
U10
CH2 TEMPERATURE
402100-004
CH2OUT
CH2IN
VSENSOR
TEMP_A2
TEMP_A1
TEMP_A0
KEY 19
NOTE: TIE PINS 3 & 20 ON BOARD
TEMP_A2
TEMP_A1
TEMP_A0
DT/CO_CH1
DT/CO_CH2
INVBP_CH1
INVBP_CH2
+2.5VREF
INVBP_CH3
INVBP_CH4
U9
DUAL INV BP
400867-001
OUT1
OUT2
VREF1
BR1+
BR1-
VREF2
BR2+
BR2-
KEY 7
NOTE: HYBRID U9 IS NOT INSTALLED IN ASSEMBLIES 800330-011 AND -012.
U7
DUAL INV BP
400867-001
NOTE: HYBRID U7 IS NOT INSTALLED IN ASSEMBLIES 800330-005, -006, -011 AND -012.
U8
QUAD BP DRIVER
401607-001
BP1DRV+
BP1DRV-
BP2DRV+
BP2DRV-
BP3DRV+
BP3DRV-
BP4DRV+
BP4DRV-
-2.5VREF
+5V
-5V
KEY 8
NOTE: HYBRID U8 IS NOT INSTALLED IN ASSEMBLIES 800330-011 AND -012.
DT/CO_IN1
DT/CO_IN2
CO_OFFSET
-0.25VREF
BP1_EXC+
BP1_EXC-
BP1_SIG+
BP1_SIG-
BP2_EXC+
BP2_EXC-
BP2_SIG+
BP2_SIG-
BP3_EXC+
BP3_EXC-
BP3_SIG+
BP3_SIG-
BP4_EXC+
BP4_EXC-
BP4_SIG+
BP4_SIG-
+5AISO
-5AISO
A
B
C
D
1
2
3
4
5
6
7
8

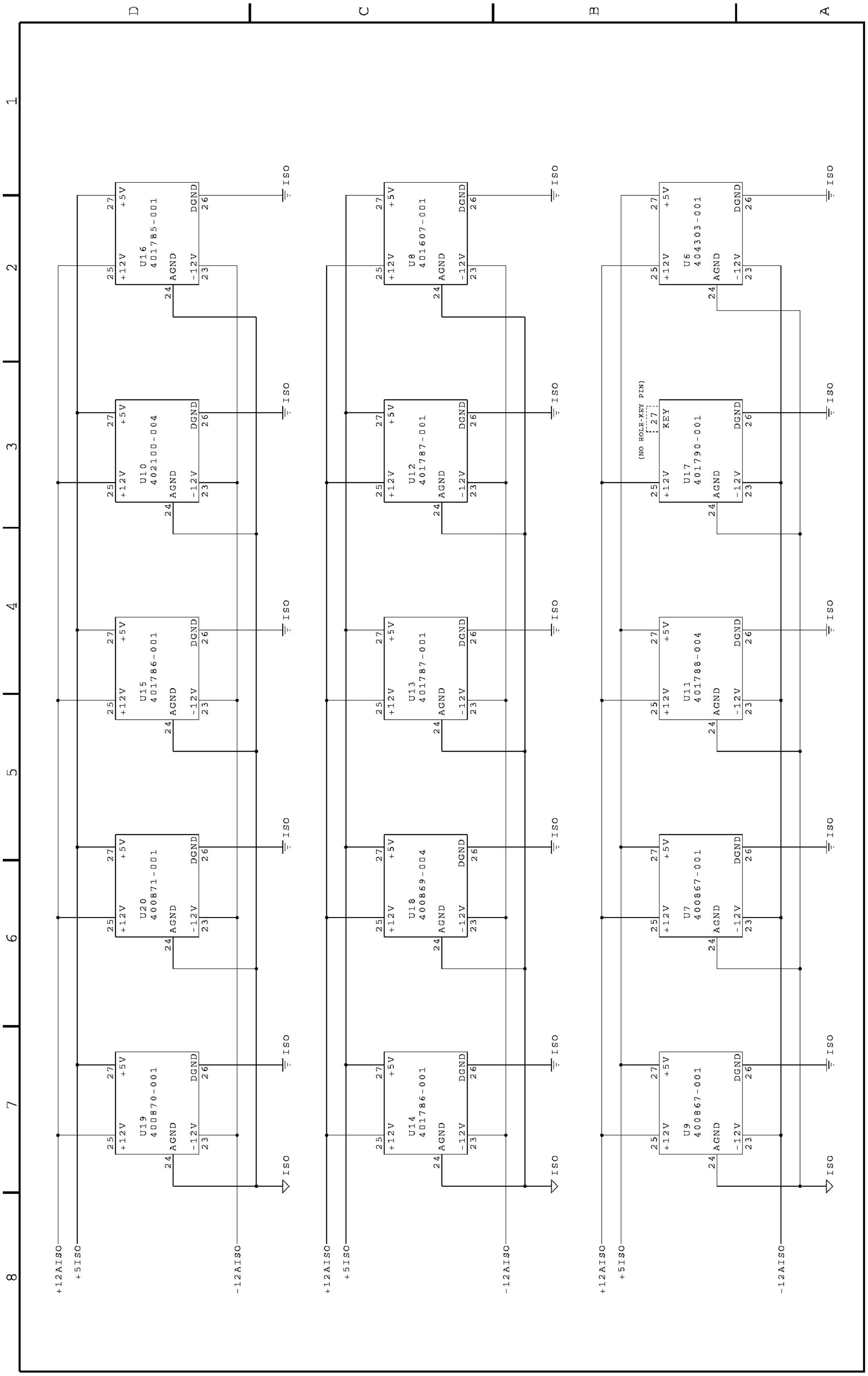
7 of 11


1
2
3
4
5
6
7
8
D
C
B
A
+5ISO
J1 -11 SPARE
J1 -12 SPARE
R14 10K
R15 10K
R7 150
R11 150
R6 150
J1 - 2
J1 - 3
J1 - 1
J1 - 4
ISO_RXD 1-D8
ISO_DEN* 1-D8
ISO_TXD 1-D8
RESP_CLK 4-C1
J1 -16
J1 -13
J1 - 9
J1 -10
J1 -14
J1 -15
J1 - 7
J1 - 8
J1 - 5
J1 - 6
+12AISO
+5AISO
-5AISO
-12AISO
+5ISO
ISO
ISO
C20 4.7 20V 20%
C12 .1
C18 10 10V 20%
C14 .1
CR4 P6KE20A
C19 4.7 20V 20%
C31 .1
C15 10 10V 20%
C13 .1
CR5 P6KE20A
C30 10 10V 20%
C33 .1
J1- TO ISO POWER SUPPLY
U30 MPX2050GP
GND 1
+OUT 2
+VREF 3
-OUT 4
PRESSURE SENSOR
SENSOR MOUNTING STANDOFFS
5
6
F-SHIELD
C34 .1
ISO
U6 NON-INVASIVE BP 404303-001
PRESSURE 15
NEO_PULS 2
PULS 1
XREF 20
21 +XDUCER
22 -XDUCER
3 ART_REJ
4 +5
18 +12
13 -12
+5ISO
+12AISO
-12AISO
NC 5 SUB
NC 7 SUB
NC 11 SUB
NC 16 SUB
NC 19 SUB
NC 6 NC
NC 8 NC
NC 9 NC
NC 12 NC
NC 14 NC
NC 17 NC
NC 28 NC
NC 29 NC
NC 30 NC
KEY 10
1-C8 ART_REJ
2-D1 NBP_PULSES
2-D1 NEO_PULSES
2-D1 PRESSURE

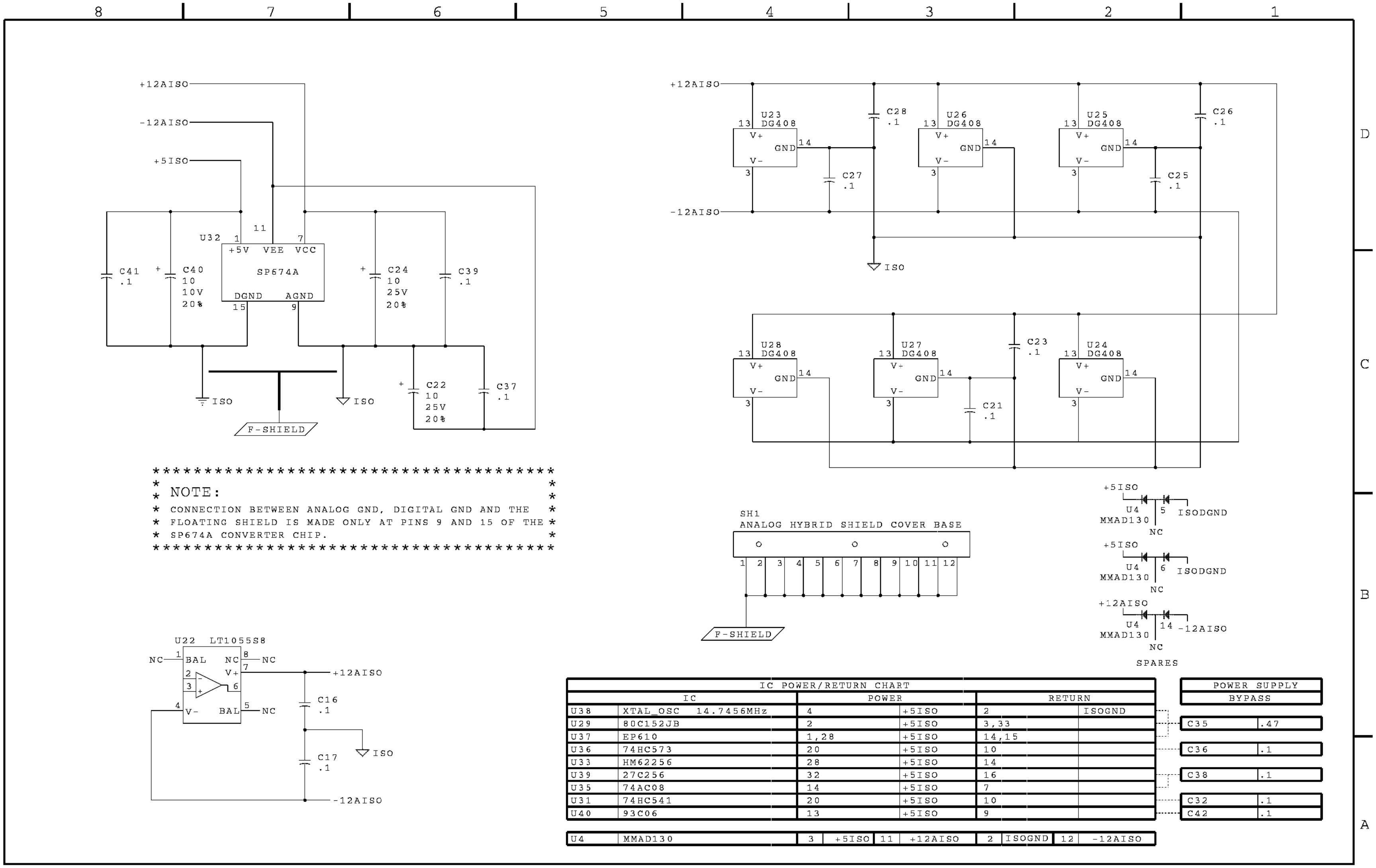
NOTE:

U6,U30, AND C34 ARE NOT INSTALLED IN ASSEMBLIES 800330-002, AND -004.

8 of 11


D
C
B
A
1
2
3
4
5
6
7
8
U16
401785-001
U10
402100-004
U15
401786-001
U20
400871-001
U19
400870-001
U8
401607-001
U12
401787-001
U13
401787-001
U18
400869-004
U14
401786-001
U6
404303-001
U17
401790-001
U11
401788-004
U7
400867-001
U9
400867-001
(NO HOLE-KEY PIN)
KEY
+5V
+12V
AGND
-12V
DGND
27
25
24
23
26
ISO
+12AISO
+5ISO
-12AISO

9 of 11



1
2
3
4
5
6
7
8
A
B
C
D
+12AISO
-12AISO
+5ISO
U32
SP674A
+5V
VEE
VCC
DGND
AGND
1
11
7
15
9
C41
.1
C40
10
10V
20%
C24
10
25V
20%
C39
.1
C22
10
25V
20%
C37
.1
ISO
F-SHIELD
U23
U26
U25
U28
U27
U24
DG408
V+
V-
GND
13
14
3
C28
.1
C27
.1
C26
.1
C25
.1
C23
.1
C21
.1
ISO
SH1
ANALOG HYBRID SHIELD COVER BASE
1
2
3
4
5
6
7
8
9
10
11
12
F-SHIELD
+5ISO
U4
MMAD130
5
ISODGND
NC
+5ISO
U4
MMAD130
6
ISODGND
NC
+12AISO
U4
MMAD130
14
-12AISO
NC
SPARES
U22
LT1055S8
NC
BAL
NC
NC
V+
V-
BAL
NC
1
2
3
4
5
6
7
8
+12AISO
C16
.1
C17
.1
ISO
-12AISO

****
* NOTE: *
* CONNECTION BETWEEN ANALOG GND, DIGITAL GND AND THE *
* FLOATING SHIELD IS MADE ONLY AT PINS 9 AND 15 OF THE *
* SP674A CONVERTER CHIP. *
****

IC POWER/RETURN CHART

IC		POWER		RETURN	
U38	XTAL_OSC 14.7456MHz	4	+5ISO	2	ISOGND
U29	80C152JB	2	+5ISO	3,33	
U37	EP610	1,28	+5ISO	14,15	
U36	74HC573	20	+5ISO	10	
U33	HM62256	28	+5ISO	14	
U39	27C256	32	+5ISO	16	
U35	74AC08	14	+5ISO	7	
U31	74HC541	20	+5ISO	10	
U40	93C06	13	+5ISO	9	

U4	MMAD130	3	+5ISO	11	+12AISO	2	ISOGND	12	-12AISO

POWER SUPPLY BYPASS

C35	.47
C36	.1
C38	.1
C32	.1
C42	.1

10 of 11

REFDES	PAGE COORDINATES
U1:	2-D5
U10:	6-B3 8-D3
U11:	6-D3 8-B5
U12:	5-C3 8-C3
U13:	5-D3 8-C5
U14:	5-C4 8-C7
U15:	5-D4 8-D5
U16:	5-D5 8-D2
U17:	5-C8 8-B3
U18:	5-D8 8-C6
U19:	4-B4 8-D7
U2:	3-B6
U20:	4-D3 8-D6
U21:	4-D8
U22:	2-C5 9-B8
U23:	2-B4 9-D4
U24:	2-D2 9-C2
U25:	2-C2 9-D2
U26:	2-D2 9-D3
U27:	2-B2 9-C3
U28:	2-B2 9-C4
U29:	1-D7 9-B5
U3:	3-B6
U30:	7-D7
U31:	3-D2 9-A5
U32:	2-C7 9-D7

REFDES	PAGE COORDINATES
U33:	1-D2 9-A5
U34:	1-B2
U35:	1-C5,D8 2-D6 9-A5
U36:	1-C4 9-A5
U37:	1-D4 9-B5
U38:	1-A8 9-B5
U39:	1-C3 9-A5
U4:	3-C7,D7 9-A5,B2,C2
U40:	2-D7 9-A5
U5:	3-C4,D4,D6
U6:	7-C6 8-B2
U7:	6-B5 8-B6
U8:	6-B8 8-C2
U9:	6-D5 8-B7

11 of 11

CONN	LABEL
J1-1:	07071024
J1-10:	ISOAGND
J1-13:	+5AISO
J1-14:	-5AISO
J1-15:	-12AISO
J1-16:	+12AISO
J1-2:	07071016
J1-3:	07071020
J1-4:	RESP_CLK
J1-5:	ISOGND
J1-6:	ISOGND
J1-7:	+5ISO
J1-8:	+5ISO
J1-9:	ISOAGND
J2-1:	ISOAGND
J2-10:	BP4_EXC-
J2-11:	FSHIELD
J2-12:	BP4_SIG+
J2-13:	FSHIELD
J2-14:	BP3_SIG+
J2-15:	BP2_SIG-
J2-16:	BP1_EXC-
J2-17:	03011027
J2-18:	BP1_SIG+
J2-19:	ISOGND
J2-2:	DT/CO_IN1
J2-20:	BP1_SIG-
J2-21:	ISOGND
J2-22:	BP3_EXC+
J2-23:	BP2_EXC-
J2-24:	BP2_SIG+
J2-25:	BP2_EXC+
J2-26:	BP3_EXC-
J2-27:	03011022
J2-28:	BP4_SIG-
J2-29:	03011007
J2-3:	ISOAGND
J2-30:	BP3_SIG-
J2-31:	03011017
J2-32:	BP1_EXC+
J2-33:	03011012
J2-34:	+0.25VREF
J2-4:	DT/CO_IN2
J2-5:	03011037
J2-6:	CO_OFFSET
J2-7:	03011032
J2-8:	BP4_EXC+
J3-1:	A/D_VCAL
J3-2:	ISOGND
J3-3:	03043042
J3-4:	ISOAGND

30

PULSE OXIMETRY PCB
PN 414409/800674/401198

General **30-2**

Exploded View PN 414409-001B **30-3**

Parts List PN 414409-001C **30-4**

Parts Location Diagram PN 800674-003A **30-5**

Parts List PN 800674-003A **30-7**

Schematic Diagram PN SD800674-003A **30-10**

Assembly Revisions PN 800674 .... **30-19**

Parts Location Diagram PN 800674-001A/002B **30-20**

Parts List PN 800674-001A/002B **30-22**

Schematic Diagram PN SD800674-002A **30-25**

General

For Tram 250, 450, 650, and 850 modules, the circuit board, pn 800674-00X, supports MEI and Nellcor SpO_2 probes and is produced by Marquette Medical Systems. The encasing housing assembly for the circuit board is pn 414409-001.

NOTE
The pulse oximetry PCB may also be referred to as SpO_2 PCB.

There are two different versions of the pulse oximetry PCB:

- pn 800674-001, which was first used in all of the A-series modules,
- pn 800674-002, which was introduced in the SL-series modules, and then added to the A-series modules, and
- pn 800674-003, which is currently used for all modules.

NOTE
Replace version -001 or -002 circuit board with a -003 circuit board, but do not replace a -003 with a -001 or -002 circuit board.

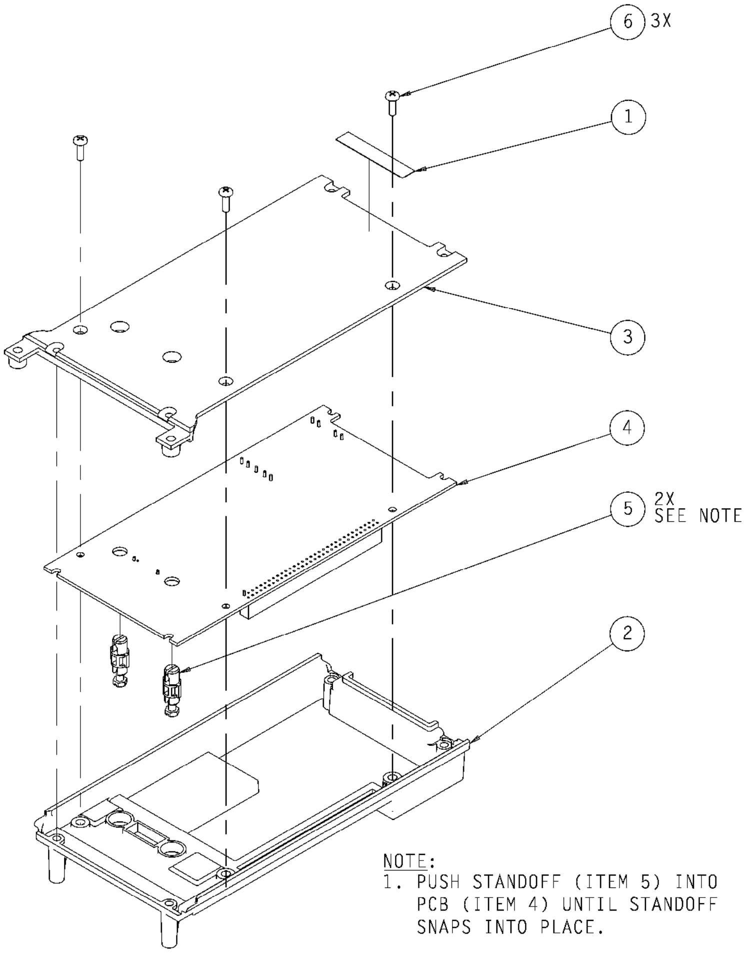
For Tram 200, 400, 600, and 800 modules, the PCB, pn 401189-001, supports Ohmeda probes and is produced by Ohmeda. Ohmeda supports this circuit board with an interface manual. The manual includes schematic diagrams, theory of operation, and troubleshooting to the component level.

For service information about the Ohmeda circuit board, the manual, *Ohmeda MINX Module Interface Manual*, pn 1128-304, is only available directly from the following address.

Ohmeda
1315 West Century Drive
Louisville, CO 80027
Phone: (303) 666-7001
(800) 652-2469
Fax: 303) 665-9231
Telex: 296 445 BTI UR

For more details about the interconnect circuit board between the Ohmeda circuit board and the power indicator circuit board, refer to chapter 25.

Exploded View PN 414409-001C



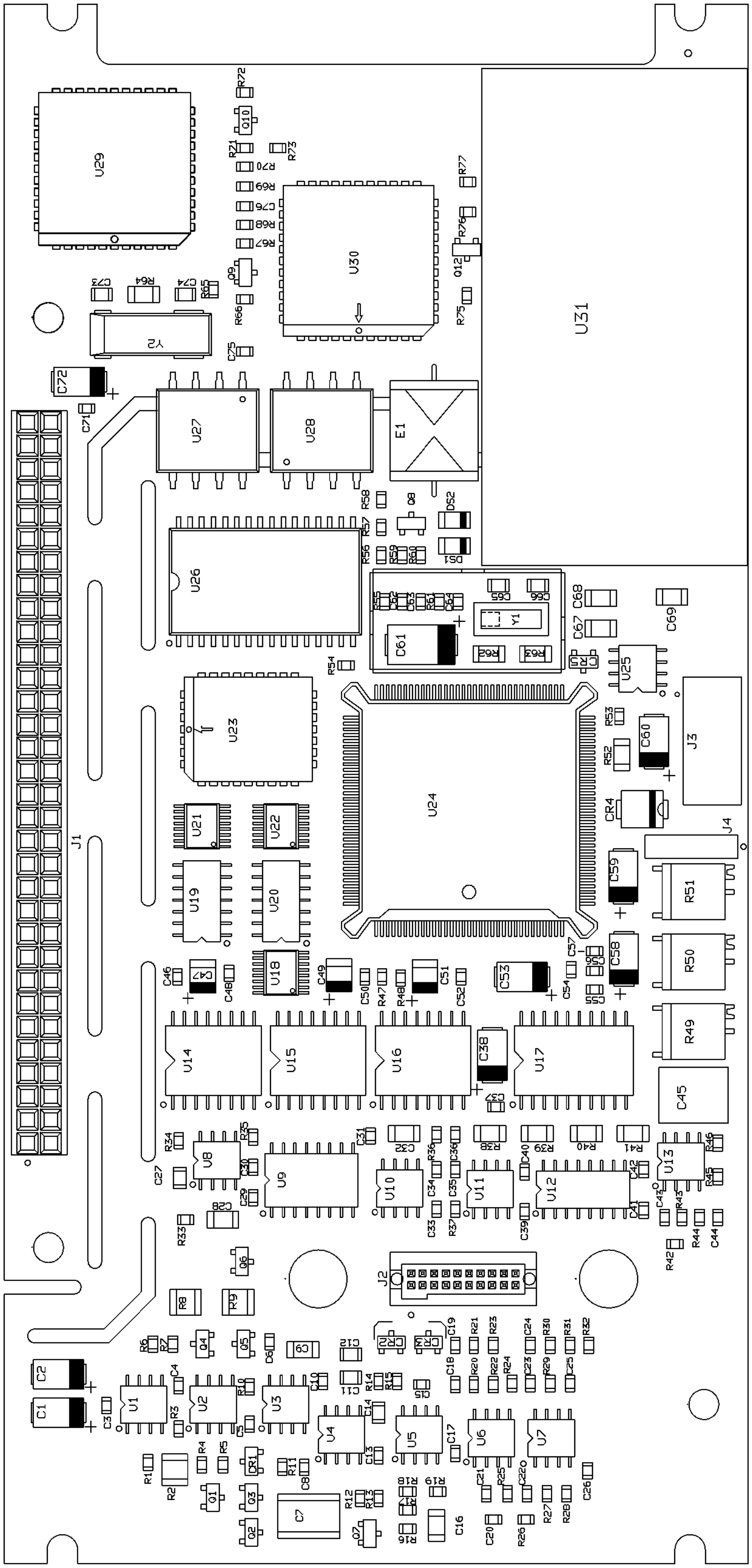
NOTE:
1. PUSH STANDOFF (ITEM 5) INTO PCB (ITEM 4) UNTIL STANDOFF SNAPS INTO PLACE.

Parts List PN 414409-001C

Item	Parts List	Part Number	Qty
1	Label	407132-002	1
2	Housing, Pulse Oximetry	412219-003	1
3	Cover, Pulse Oximetry	412248-001	1
4	Pulse Oximetry PCB	800674-003	1
5	Standoff, 1/4-Turn, 0.25	413454-001	2
6	Screw, BDGH, 4-40 x 3/8	45074-412	3
1	Label	407132-002	1

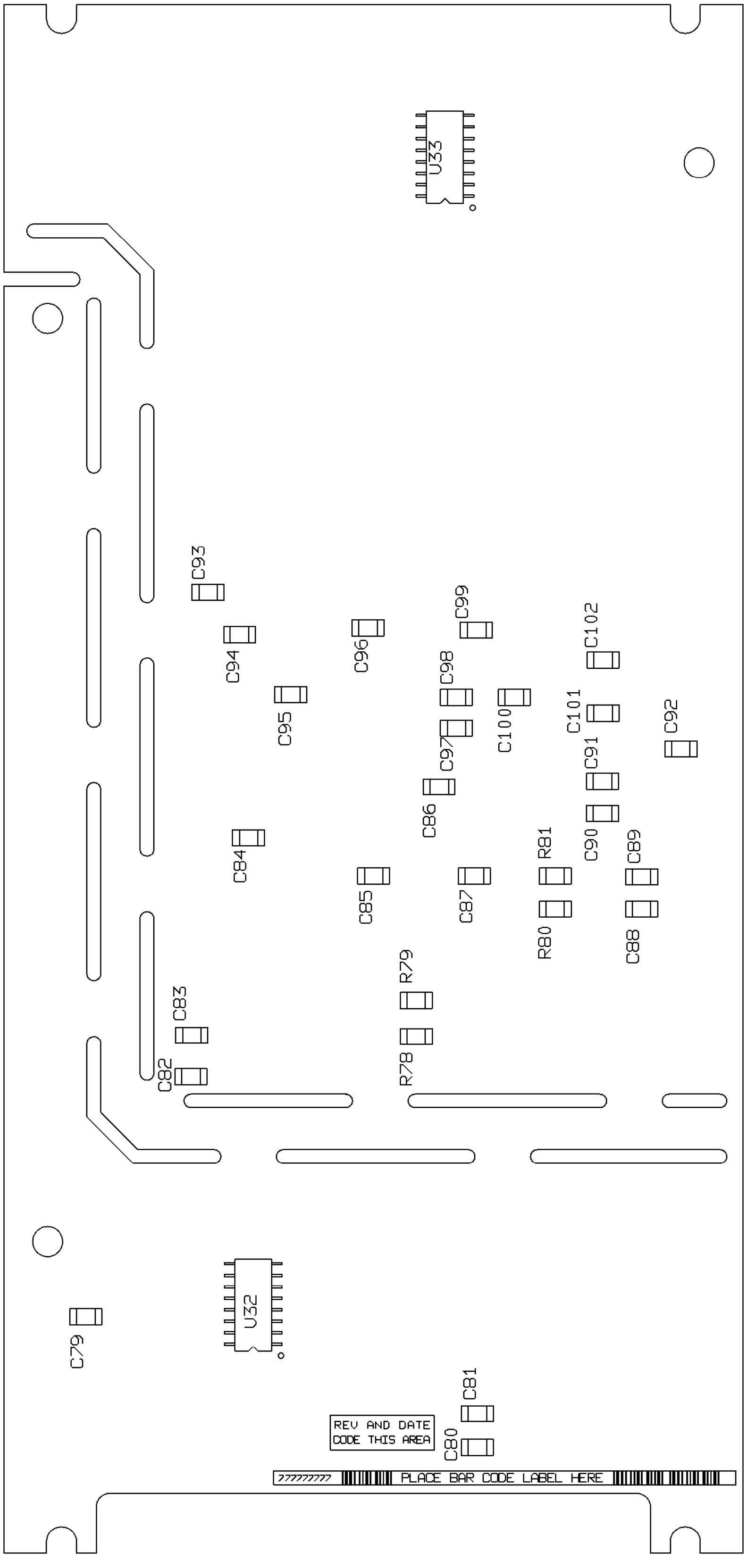
Parts Location Diagram PN 800674-003A

1 of 2



U29
R72
Q10
R21
R73
R70
R69
C76
R68
R67
R77
R76
U30
Q12
Q9
R75
C73
R64
C74
R65
R66
Y2
C75
U31
C72
C71
U27
U28
E1
R58
Q8
DS2
R57
R56
R59
R60
DS1
U26
C55
C62
C63
C61
C64
C65
C66
C68
C67
Y1
C69
R62
R63
R54
U25
U23
U24
R53
C60
R52
J3
CR4
J4
U21
U22
J1
U19
U20
C59
R51
C57
C56
C58
R50
C46
C47
C48
U18
C49
C50
R47
R48
C51
C52
C53
C54
C55
R49
U14
U15
U16
C38
U17
C37
C45
R34
R35
U8
C31
C32
R36
C36
R38
C40
R39
R40
R41
R46
U13
C27
C30
U9
U10
C34
C35
U11
U12
C42
R45
C29
C28
C41
C43
R43
R33
C33
R37
C39
R44
C44
R42
Q6
J2
R8
R9
C19
R21
R23
C24
R30
R31
R32
R6
R7
Q4
Q5
D6
C9
C12
CR2
CR3
C18
R20
R22
R24
C23
R29
C25
C2
C4
R10
C10
R14
R15
C11
C15
C1
C3
U1
U2
U3
R3
C5
C14
U4
U5
C17
U6
U7
R4
R5
R1
R2
CR1
R11
C8
C13
R18
R19
C21
R25
C22
C26
Q1
Q3
C7
R12
R13
R17
R27
R28
C16
Q2
Q7
R16
C20
R26

2 of 2


U33
C93
C99
C102
C94
C96
C98
C95
C100
C101
C92
C97
C91
C86
C84
C90
R81
C89
C85
C87
R80
C88
R79
C83
C82
R78
U32
C79
C81
C80
REV AND DATE CODE THIS AREA
PLACE BAR CODE LABEL HERE

Parts List PN 800674-003A

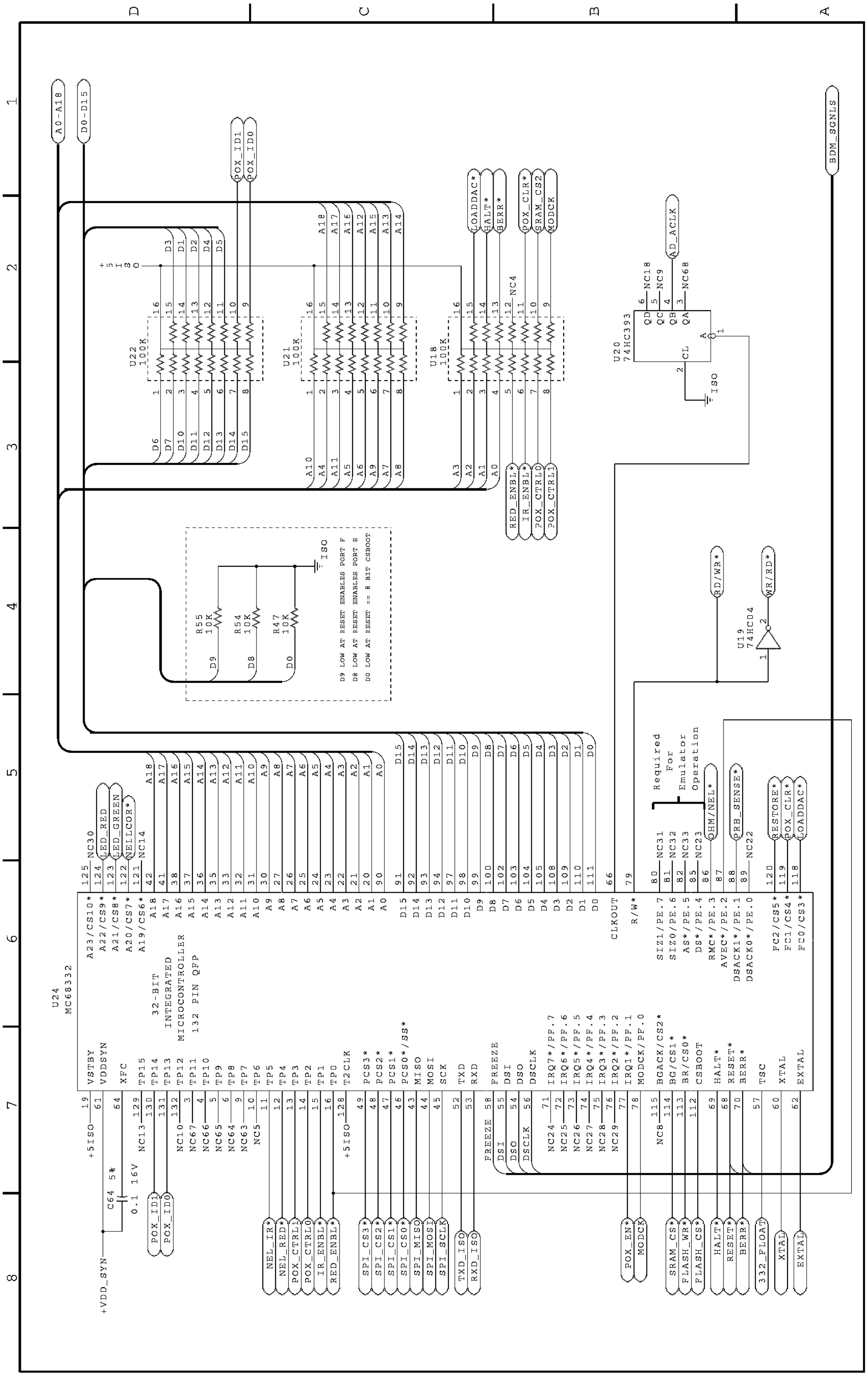
Item	Parts List	Part Number	Qty
C1, 2, 38, 53, 58-60, 72	Cap, Tant, 10µF, 20%, 16V, SM	1176-106	8
C3, 20, 22, 24, 25, 34, 36, 43, 46, 48, 50, 52, 57, 62, 71	Cap, Cer, 0.1µF, 5%, 50V	411575-012	15
C4-6, 8, 10, 13, 15, 17-19, 21, 23, 26, 29-31, 33, 35, 37, 39, 40-42, 44, 54-56, 63, 64, 75, 76	Cap, Cer, 0.1µF, 5%, 16V	411575-002	31
C7	Cap, Cer, 0.33µF, 5%, 50V	1181-334	1
C9, 28, 32	Cap, Cer, 0.0015µF, 5%, SM	1181-152	3
C11	Cap, Cer, 470pF, 5%, 50V, SM	1181-471	1
C12	Cap, Cer, 0.001µF, 5%, 50V, SM	1181-102	1
C14, 65, 66, 73, 74	Cap, Cer, 22pF, 5%, 50V, SM	1181-220	5
C16	Cap, Cer, 0.1µF, 5%, 50V, SM	1182-104	1
C27	Cap, Cer, 150pF, 5%, 50V, SM	1181-151	1
C45	Cap, PP, 0.01µF, 1%, 63V	408822-001	1
C47, 49, 51	Cap, Tant, 1.0µF, 10%, 35V, SM	403907-001	3
C61	Cap, Tant, 47µF, 20%, 10V, SM	405585-001	1
C67, 69, 79, 81-87, 89-102	Cap, Cer, 0.1µF, 20%, 50V	404370-001	24
C68, 80, 88	Cap, Cer, 0.01µF, 5%, 50V, SM	400265-001	3
CR1	Diode, SM MMAD4148	401980-001	1
CR2, 3	Diode, SM FDSO1503	2414-001	2
CR4	Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3	403187-001	1
CR5	Diode, Schottky, SM BAT54	401985-001	1
DS1	Diode, Light-Emitting (Green)	414417-004	1
DS2	Diode, Light-Emitting (Red)	414417-002	1
E1	Surge Protector, 7.5kV, ±15%	1931-001	1
J1	Connector, PC Header, 64-Pin	1847-064	1
J2	Connector, PC Header, 20-Pin, SM	413053-002	1
J3	PC Post, 2 x 5-Pin	413864-001	1
J4	PC Post, 1 x 4-Pin	413864-002	1
Q1, 4	Transistor, PNP, SM T2907A	405759-001	2
Q2, 5	Transistor, NPN, SM MMBT222	404927-001	2
Q3, 6	Transistor, MOSFET, N-Channel, Enhancement Mode, SM VN0605T	406267-001	2
Q7	Transistor, JFET, P-Channel, SM MMBFJ117	404417-001	1
Q8, 9	Transistor, PNP, SM T3906	2511-101	2
Q10, 12	Transistor, NPN, SM T3904	2511-001	2
R1, 7, 48	Res, Cer, 100K, 1%, 1/16W, SM	410334-019	3
R2, 8, 9	Res, Cer, 10.0K, 1%, 1/4W	407468-002	3

Item	Parts List	Part Number	Qty
R3, 11, 20-23, 27, 28, 30, 32, 43, 47, 53-55, 57, 60, 65, 68-73, 75-77	Res, Cer, 10K, 1%, 1/16W, SM	410334-013	27
R4-6, 10	Res, Cer, 4.75K, 1%, 1/16W, SM	410334-010	4
R12	Res, Cer, 475Ω, 1%, 1/16W, SM	410334-064	1
R13	Res, Cer, 499K, 1%, 1/16W, SM	410334-072	1
R14, 15	Res, Cer, 23.2K, 1%, 1/16W, SM	410334-069	2
R16, 17, 34	Res, Cer, 301K, 1%, 1/16W, SM	410334-071	3
R18, 19, 56	Res, Cer, 1K, 1%, 1/16W, SM	410334-008	3
R24	Res, Cer, 150Ω, 1%, 1/16W, SM	410334-028	1
R25, 29, 42, 61	Res, Cer, 100Ω, 1%, 1/16W, SM	410334-003	4
R26	Res, Cer, 16.5K, 1%, 1/16W, SM	410334-068	1
R31	Res, Cer, 38.3K, 1%, 1/16W, SM	410334-047	1
R33, 35	Res, Cer, 3.01K, 1%, 1/16W, SM	410334-018	2
R36	Res, Cer, 2K, 1%, 1/16W, SM	410334-009	1
R37	Res, Cer, 4.99K, 1%, 1/16W, SM	410334-066	1
R38	Res, Cer, 200K, 0.1%, 1/8W, SM	1067-832	1
R39	Res, Cer, 38.8K, 0.1%, 1/8W, SM	1067-388	1
R40	Res, Cer, 248K, 0.1%, 1/8W, SM	1067-249	1
R41	Res, Cer, 178K, 0.1%, 1/8W, SM	1067-849	1
R44	Res, Cer, 11.5K, 1%, 1/16W, SM	410334-014	1
R45, 46	Res, Cer, 75K, 1%, 1/16W, SM	410334-063	2
R49, 50, 51	Res, Var, 2K, Side Adjust, SM	409023-003	3
R52	Res, Cer, 1.5K, 1%, 1/8W, SM	1082-768	1
R58, 66	Res, Cer, 681Ω, 1%, 1/16W, SM	410334-065	2
R59, 67	Res, Cer, 8.66K, 1%, 1/16W, SM	410334-067	2
R62	Res, Cer, 20M, 1%, 1/8W, SM	1081-510	1
R63	Res, Cer, 332K, 1%, 1/8W, SM	1082-874	1
R64	Res, Cer, 10M, 5%, 1/8W, SM	1081-106	1
R78, 79	Res, 340 Ω, 1%, 1/8W, SM	1082-790	2
R80, 81	Res, Cer, 10K, 1%, 1/8W, SM	1082-104	2
SH1	Shield, Crystal (For Y1)	411267-003	1
U1	Volt Rgltr, Adj, SM LP2951A	3076-001	1
U2-4, 7, 8, 10, 11, 13	Operational Ampl, Dual, SM TLC2272	412809-001	8
U5	Operational Ampl, SM TLC2201	403385-002	1
U6	Voltage Reference, 2.5V, SM AD680	410736-001	1
U9	Res, Ntwk, 10K, 0.1%, SM	405134-001	1
U12	Analog Switch, SPST, CMOS, Quad DG413	408821-001	1
U14-16	DAC, 12-Bit, SM 7543	405439-001	3
U17	Data Acquisition, SM LTC1290	405948-002	1
U18,21, 22	Res, Ntwk, 100K	1049-203	3
U19	Inverter, Hex, SM HC04	3038-004	1
U20	Counter, Binary, 4-Bit, Dual, SM HC393	3038-393	1
U23	EEPROM, Flash Memory, Tram SpO_2	414474-003	1

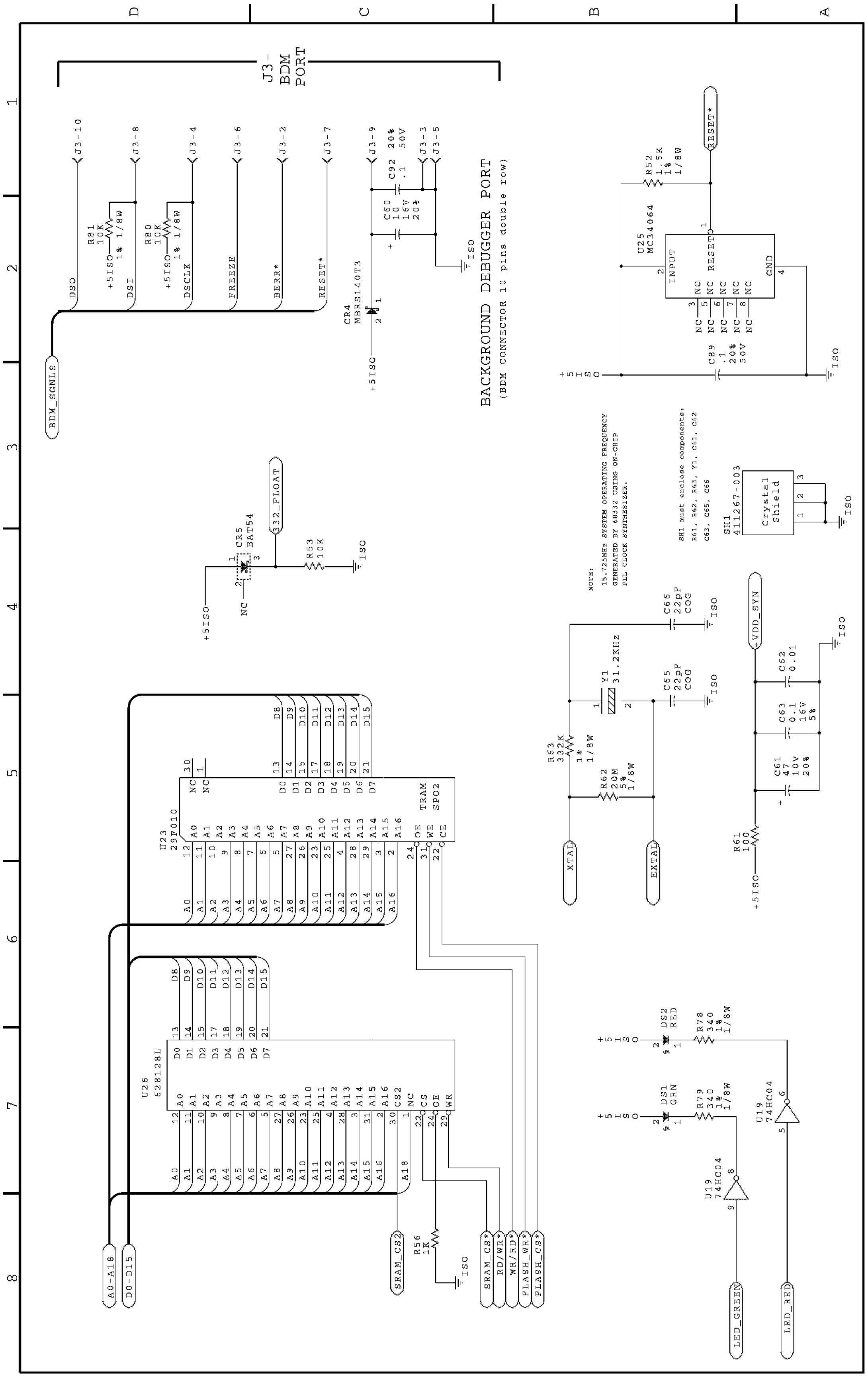
Item	Parts List	Part Number	Qty
U24	Microcontroller, 16-MHz, SM 68332	408794-001	1
U25	Sensor, Undervoltage, 4.6V, SM MC34064D5	408952-001	1
U26	RAM, Static, 128K x 8-Bit, 70nS, SM 628128	406255-002	1
U27, 28	Isolator, Optically Coupled, SM 2611	408825-001	2
U29	EPROM, Tram SpO_2 Communication	414443-002	1
U30	Programmable Peripheral Interface, PLCC 82C55A	404697-001	1
U31	Converter, DC-to-DC, Isolated, ±5V	416151-001	1
U32	Res Ntwk, 100K, SM	1061-104	1
U33	Diode Pair Array, ESD/Overvoltage Protection, SM	412586-001	1
Y1	Crystal, 31.2kHz, SM	408946-001	1
Y2	Crystal Oscillator, 3.6864-MHz, SM	408828-001	1
-	Circuit Board	800675-003A	1
-	Schematic Diagram	SD8000674-003A	–

Schematic Diagram PN SD800674-003A

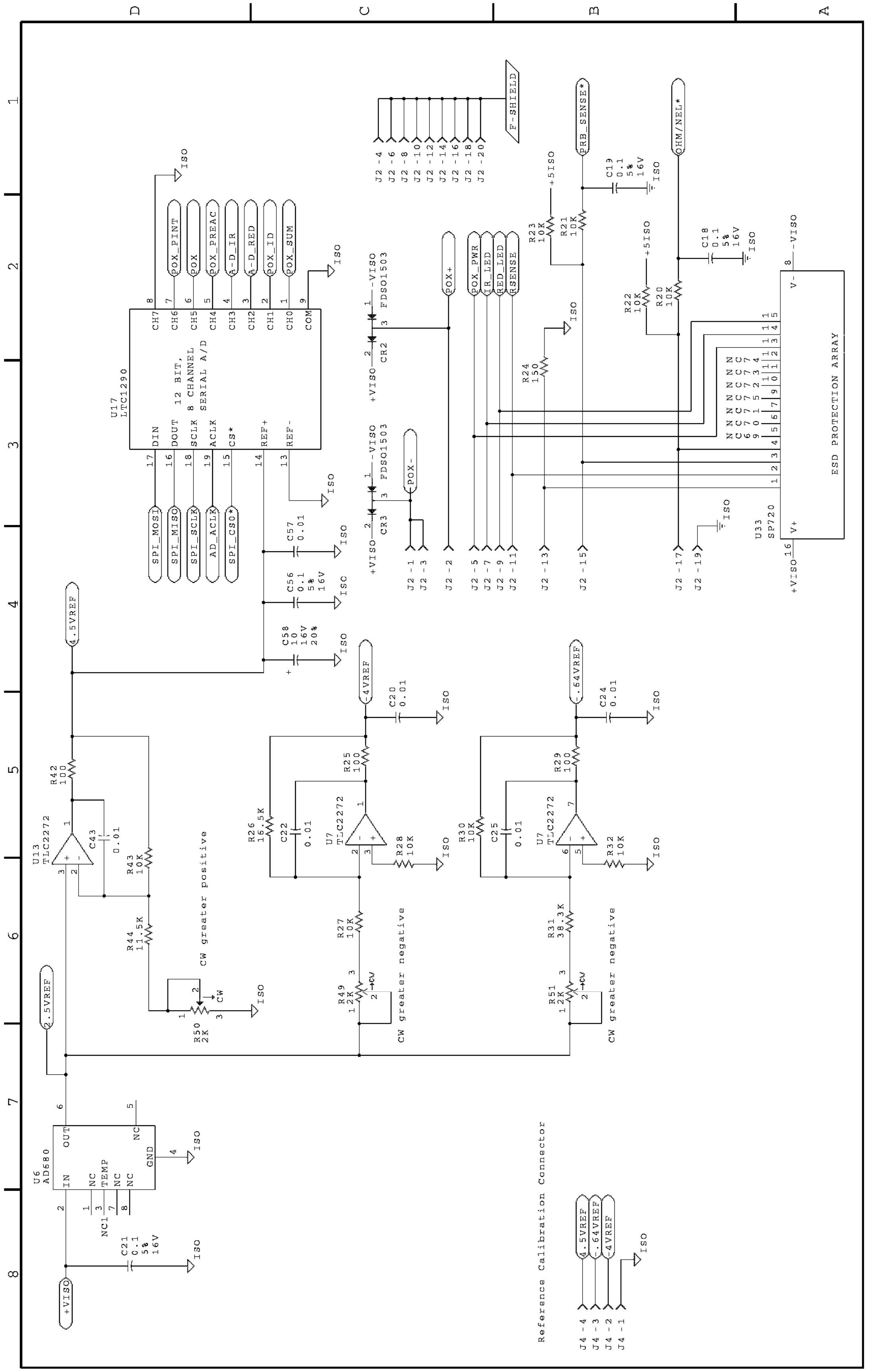
1 of 9


U24
MC68332
32-BIT
INTEGRATED
MICROCONTROLLER
132 PIN QFP
U22
100K
U21
100K
U18
100K
U20
74HC393
U19
74HC04
R55
10K
R54
10K
R47
10K
C64 5%
0.1 16V
D9 LOW AT RESET ENABLES PORT F
D8 LOW AT RESET ENABLES PORT E
D0 LOW AT RESET == 8 BIT CSBOOT
Required
For
Emulator
Operation
A0-A18
D0-D15
POX_ID1
POX_ID0
LOADDAC*
HALT*
BERR*
POX_CLR*
SRAM_CS2
MODCK
AD_ACLK
BDM_SGNLS
RED_ENBL*
IR_ENBL*
POX_CTRL0
POX_CTRL1
RD/WR*
WR/RD*
OHM/NEL*
PRB_SENSE*
RESTORE*
LED_RED
LED_GREEN
NELLCOR*
+VDD_SYN
+5ISO
ISO
NEL_IR*
NEL_RED*
SPI_CS3*
SPI_CS2*
SPI_CS1*
SPI_CS0*
SPI_MISO
SPI_MOSI
SPI_SCLK
TXD_ISO
RXD_ISO
POX_EN*
SRAM_CS*
FLASH_WR*
FLASH_CS*
RESET*
332_FLOAT
XTAL
EXTAL
D
C
B
A
1
2
3
4
5
6
7
8

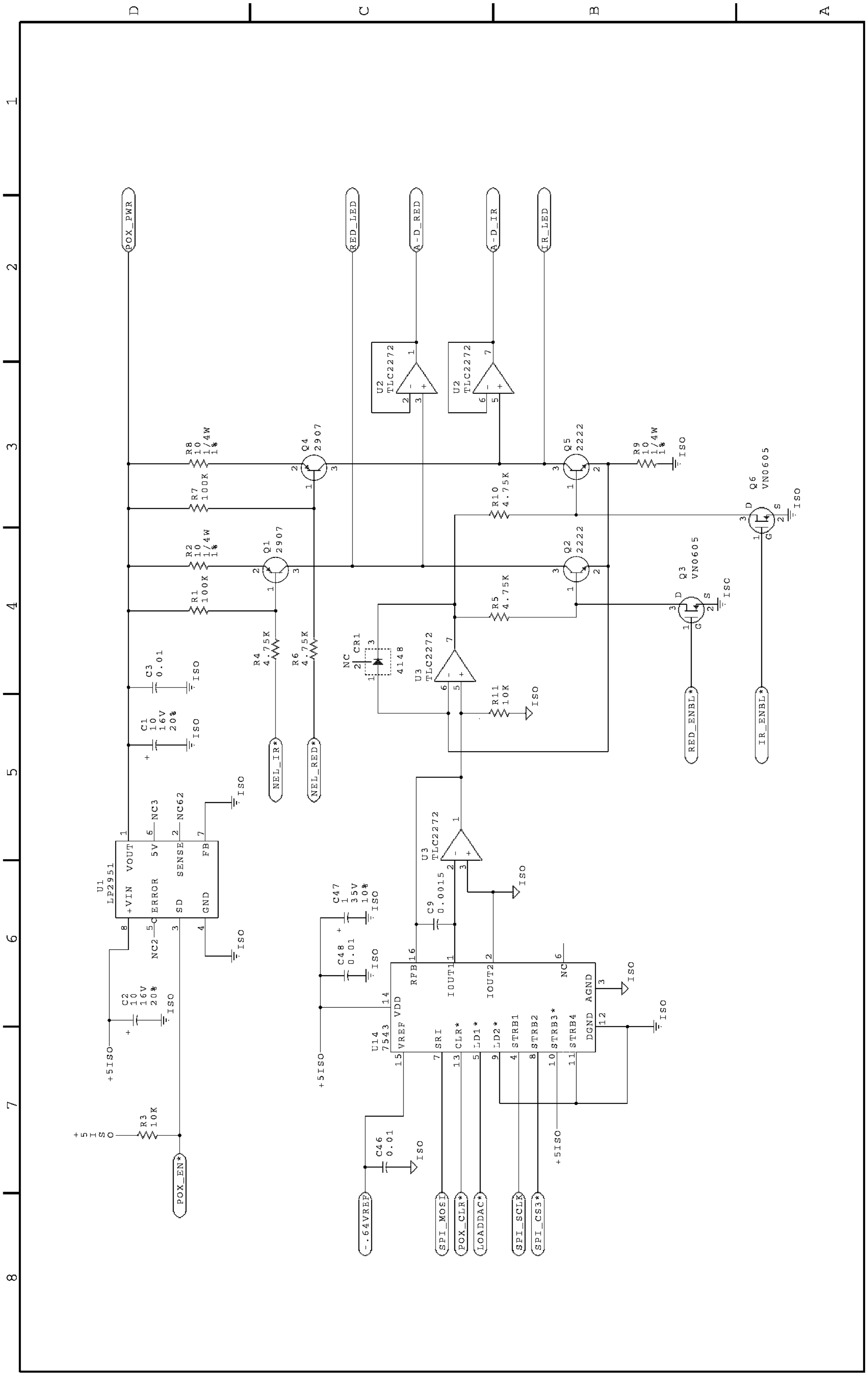
2 of 9


J3-BDM PORT
J3-10
J3-8
J3-4
J3-6
J3-2
J3-7
J3-9
J3-3
J3-5
DSO
DSI
DSCLK
FREEZE
BERR*
RESET*
R81 10K 1% 1/8W
R80 10K 1% 1/8W
+5ISO
BDM_SGNLS
C92 .1 20% 50V
C60 10 16V 20%
CR4 MBRS140T3
ISO
BACKGROUND DEBUGGER PORT
(BDM CONNECTOR 10 pins double row)
R52 1.5K 1% 1/8W
RESET*
U25 MC34064
INPUT
RESET
GND
NC
C89 .1 20% 50V
+5ISO
NOTE:
15.725MHz SYSTEM OPERATING FREQUENCY
GENERATED BY 68332 USING ON-CHIP
PLL CLOCK SYNTHESIZER.
SH1 must enclose components:
R61, R62, R63, Y1, C61, C62
C63, C65, C66
SH1 411267-003
Crystal Shield
332_FLOAT
CR5 BAT54
R53 10K
NC
C66 22pF COG
Y1 31.2KHz
C65 22pF COG
VDD_SYN
C62 0.01
C63 0.1 16V 5%
C61 47 10V 20%
R63 332K 1% 1/8W
R62 20M 5% 1/8W
R61 100
XTAL
EXTAL
U23 29F010
TRAM SP02
OE
WE
CE
A0-A18
D0-D15
D8 D9 D10 D11 D12 D13 D14 D15
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16
U26 628128L
CS
CS2
WR
A18
SRAM_CS2
R56 1K
SRAM_CS*
RD/WR*
WR/RD*
FLASH_WR*
FLASH_CS*
DS2 RED
R78 340 1% 1/8W
DS1 GRN
R79 340 1% 1/8W
U19 74HC04
LED_GREEN
LED_RED
A
B
C
D
1
2
3
4
5
6
7
8

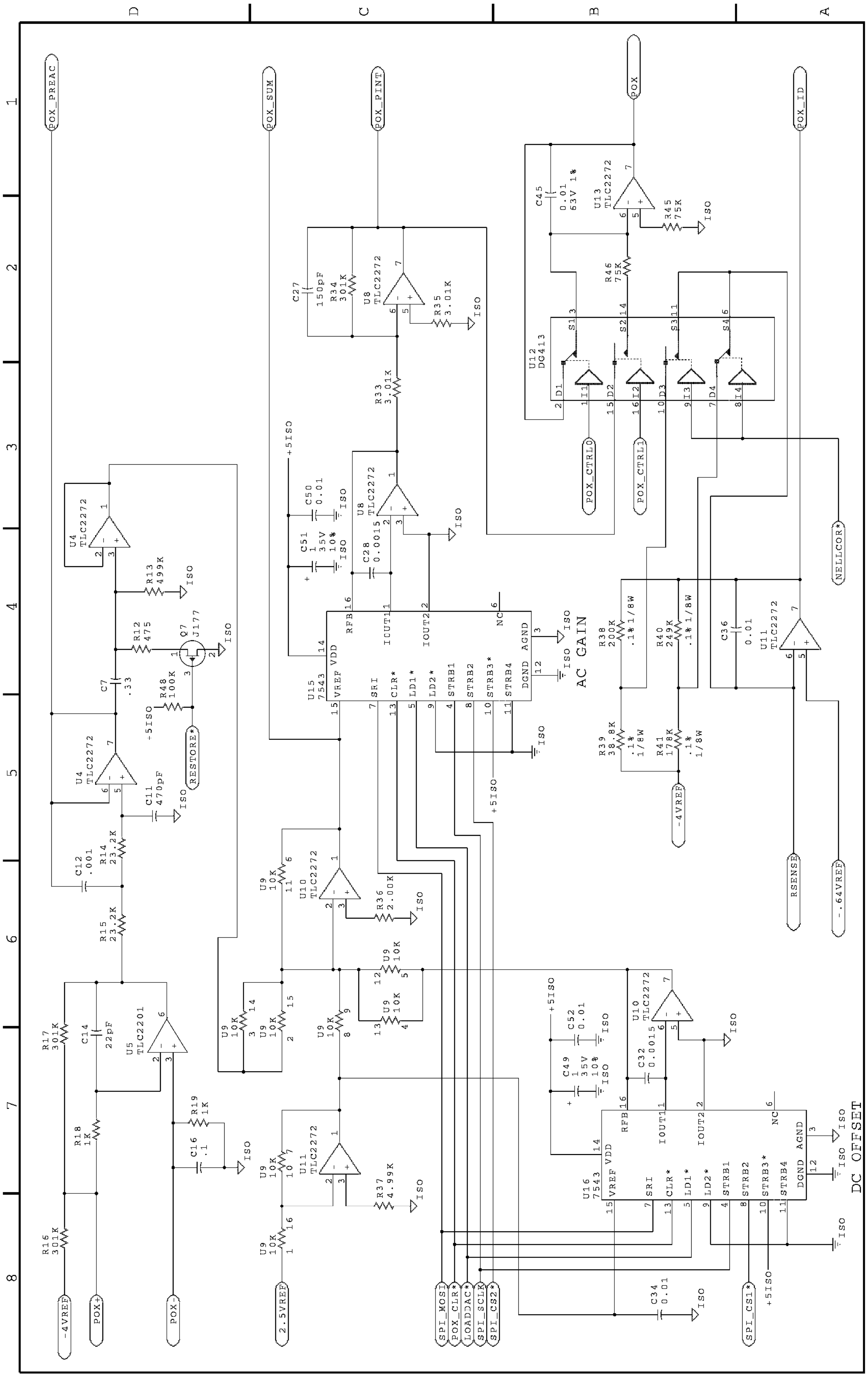
3 of 9


D
C
B
A
1
2
3
4
5
6
7
8
U17
LTC1290
12 BIT,
8 CHANNEL
SERIAL A/D
CH7
CH6
CH5
CH4
CH3
CH2
CH1
CH0
COM
DIN
DOUT
SCLK
ACLK
CS*
REF+
REF-
POX_PINT
POX
POX_PREAC
A-D_IR
A-D_RED
POX_ID
POX_SUM
SPI_MOSI
SPI_MISO
SPI_SCLK
AD_ACLK
SPI_CS0*
ISO
4.5VREF
C57 0.01
C56 0.1 5% 16V
C58 10 16V 20%
+VISO
-VISO
CR2 FDSO1503
CR3 FDSO1503
POX+
POX-
POX_PWR
IR_LED
RED_LED
RSENSE
F-SHIELD
PRB_SENSE*
OHM/NEL*
+5ISO
R23 10K
R21 10K
C19 0.1 5% 16V
R22 10K
R20 10K
C18 0.1 5% 16V
R24 150
U33 SP720
ESD PROTECTION ARRAY
V-
V+
NC6 NC7 NC9 NC10 NC5 NC7 NC2 NC3 NC4
J2-1
J2-3
J2-2
J2-5
J2-7
J2-9
J2-11
J2-13
J2-15
J2-17
J2-19
J2-4
J2-6
J2-8
J2-10
J2-12
J2-14
J2-16
J2-18
J2-20
U13 TLC2272
R42 100
C43 0.01
R43 10K
R44 11.5K
R50 2K
CW greater positive
.4VREF
C20 0.01
R25 100
R26 16.5K
C22 0.01
U7 TLC2272
R28 10K
R27 10K
R49 1.2K
CW greater negative
.64VREF
C24 0.01
R29 100
R30 10K
C25 0.01
R32 10K
R31 38.3K
R51 1.2K
CW
2.5VREF
U6 AD680
IN
NC
TEMP
GND
OUT
NC1
C21 0.1 5% 16V
+VISO
Reference Calibration Connector
J4-4
J4-3
J4-2
J4-1

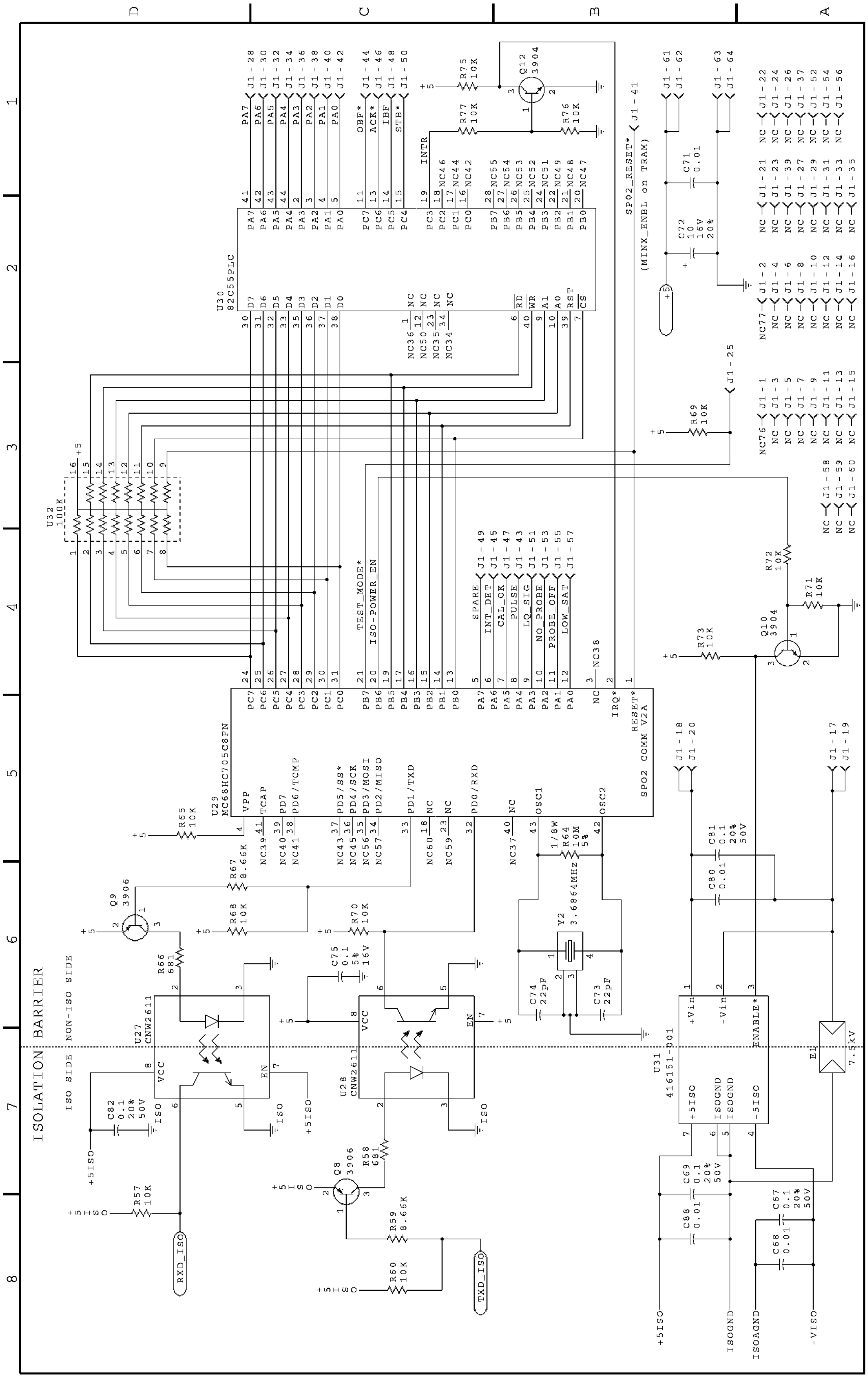
4 of 9


POX_PWR
RED_LED
A-D_RED
A-D_IR
IR_LED
U2 TLC2272
U3 TLC2272
Q4 2907
Q5 2222
Q1 2907
Q2 2222
Q3 VN0605
Q6 VN0605
R8 10 1/4W 1%
R7 100K
R2 10 1/4W 1%
R1 100K
R9 10 1/4W 1%
R10 4.75K
R5 4.75K
R4 4.75K
R6 4.75K
R11 10K
CR1 4148
NC
C3 0.01
C1 10 16V 20%
C2 10 16V 20%
C47 1 35V 10%
C48 0.01
C9 0.0015
C46 0.01
R3 10K
U1 LP2951
+VIN VOUT 5V SENSE FB ERROR SD GND
NC2 NC3 NC62
U14 7543
VREF VDD RFB IOUT1 IOUT2 NC AGND DGND SRI CLR* LD1* LD2* STRB1 STRB2 STRB3* STRB4
ISO
+5ISO
NEL_IR*
NEL_RED*
RED_ENBL*
IR_ENBL*
POX_EN*
-.64VREF
SPI_MOSI
POX_CLR*
LOADDAC*
SPI_SCLK
SPI_CS3*
D C B A
1 2 3 4 5 6 7 8

5 of 9


D
C
B
A
1
2
3
4
5
6
7
8
POX_PREAC
POX_SUM
POX_PINT
POX
POX_ID
AC GAIN
DC OFFSET
U15
7543
U16
7543
U12
DG413
U4
TLC2272
U5
TLC2201
U8
TLC2272
U10
TLC2272
U11
TLC2272
U13
TLC2272
U9
10K
Q7
J177
C45
0.01
63V 1%
R45
75K
R46
75K
C27
150pF
R34
301K
R35
3.01K
R33
3.01K
C50
0.01
C51
1
35V
10%
C28
0.0015
R38
200K
.1% 1/8W
R40
249K
R39
38.8K
R41
178K
C36
0.01
R13
499K
R12
475
R48
100K
C7
.33
C11
470pF
C12
.001
R14
23.2K
R15
23.2K
R17
301K
C14
22pF
R18
1K
R19
1K
C16
.1
R16
301K
R36
2.00K
R37
4.99K
C52
0.01
C49
1
35V
10%
C32
0.0015
C34
0.01
ISO
+5ISO
-5ISO
RESTORE*
POX_CTRL0
POX_CTRL1
NELLCOR*
RSENSE
-.64VREF
-4VREF
POX+
POX-
2.5VREF
SPI_MOSI
POX_CLR*
LOADDAC*
SPI_SCLK
SPI_CS2*
SPI_CS1*
VREF
VDD
RFB
IOUT1
IOUT2
NC
AGND
DGND
SRI
CLR*
LD1*
LD2*
STRB1
STRB2
STRB3*
STRB4

6 of 9


U30
82C55PLC
U29
MC68HC705C8FN
U32
100K
U27
CNW2611
U28
CNW2611
U31
416151-001
Q12
3904
Q10
3904
Q9
3906
Q8
3906
Y2
3.6864MHz
E1
7.5kV
ISOLATION BARRIER
ISO SIDE
NON-ISO SIDE
SPO2 COMM V2A
SPO2_RESET*
(MINX_ENBL on TRAM)
RXD_ISO
TXD_ISO
+5ISO
ISOGND
ISOAGND
-VISO
TEST_MODE*
ISO-POWER_EN
SPARE
INT_DET
CAL_OK
PULSE
LQ_SIG
NO_PROBE
PROBE_OFF
LOW_SAT
INTR
OBF*
ACK*
IBF
STB*
D
C
B
A
1
2
3
4
5
6
7
8

7 of 9

IC POWER/RETURN CHART				POWER SUPPLY BYPASS			
IC		POWER	RETURN	REFD	VALUE	PWR	RTN
U29	68HC705	44	22	C79	0.1	+5	GND
U30	82C55PLC	29	8	C76	0.1	+5	GND

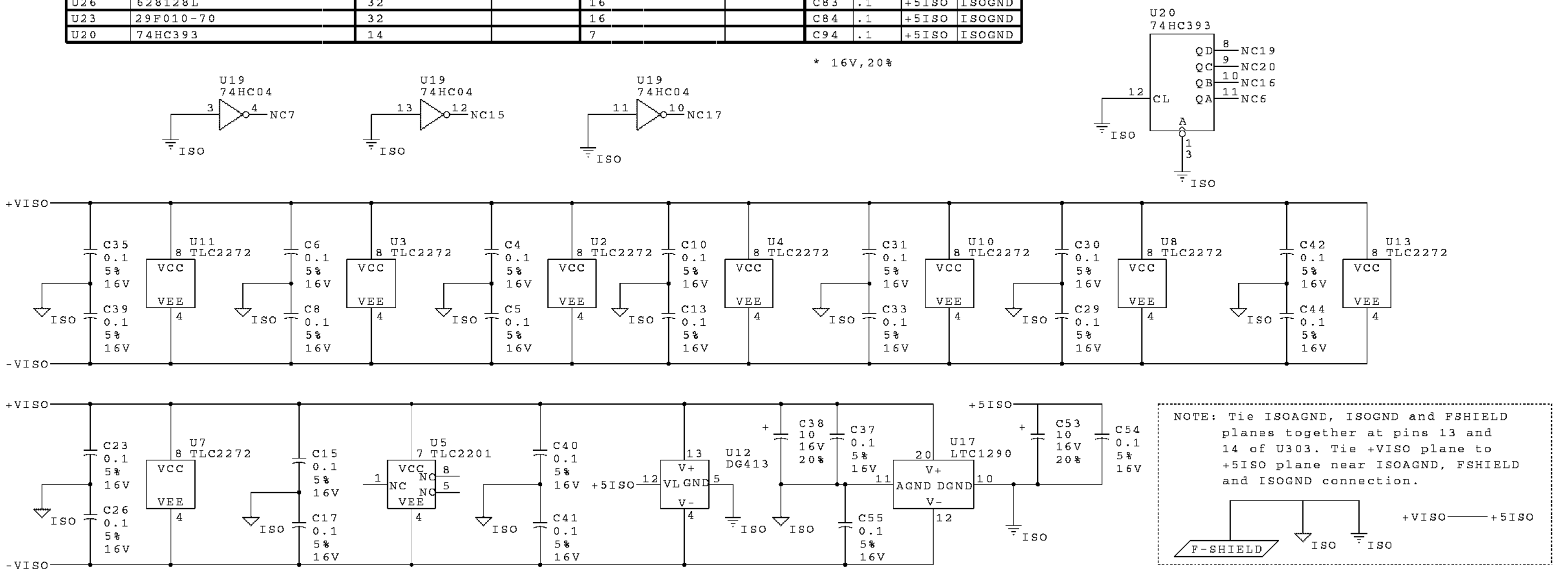
ISOLATION BARRIER

Non-iso Side

Iso Side

IC POWER/RETURN CHART				POWER SUPPLY BYPASS				POWER SUPPLY BYPASS				POWER SUPPLY BYPASS			
IC		POWER	RETURN	REFD	VALUE	PWR	RTN	REFD	VALUE	PWR	RTN	REFD	VALUE	PWR	RTN
U24	MC68332	1,7,18,28,39, 50,63,65,84, 96,107,116,126	2,8,17,29,40,51 59,67,83,95,101 106,117,127,34	C59	10*	+5ISO	ISOGND	C86	.1	+5ISO	ISOGND	C101	.1	+5ISO	ISOGND
				C95	.1	+5ISO	ISOGND	C91	.1	+5ISO	ISOGND	C102	.1	+5ISO	ISOGND
				C96	.1	+5ISO	ISOGND	C100	.1	+5ISO	ISOGND				
				C87	.1	+5ISO	ISOGND	C90	.1	+5ISO	ISOGND				
				C85	.1	+5ISO	ISOGND	C99	.1	+5ISO	ISOGND				
				C98	.1	+5ISO	ISOGND	C97	.1	+5ISO	ISOGND				
U19	74HC04	14	7	C93	.1	+5ISO	ISOGND								
U26	628128L	32	16	C83	.1	+5ISO	ISOGND								
U23	29F010-70	32	16	C84	.1	+5ISO	ISOGND								
U20	74HC393	14	7	C94	.1	+5ISO	ISOGND								

* 16V,20%


U19
74HC04
3
4
NC7
ISO
U19
74HC04
13
12
NC15
ISO
U19
74HC04
11
10
NC17
ISO
U20
74HC393
QD
QC
QB
QA
8
9
10
11
NC19
NC20
NC16
NC6
12
CL
A
1
3
ISO
+VISO
-VISO
C35 0.1 5% 16V
C39 0.1 5% 16V
U11 TLC2272
C6 0.1 5% 16V
C8 0.1 5% 16V
U3 TLC2272
C4 0.1 5% 16V
C5 0.1 5% 16V
U2 TLC2272
C10 0.1 5% 16V
C13 0.1 5% 16V
U4 TLC2272
C31 0.1 5% 16V
C33 0.1 5% 16V
U10 TLC2272
C30 0.1 5% 16V
C29 0.1 5% 16V
U8 TLC2272
C42 0.1 5% 16V
C44 0.1 5% 16V
U13 TLC2272
VCC
VEE
8
4
ISO
C23 0.1 5% 16V
C26 0.1 5% 16V
U7 TLC2272
C15 0.1 5% 16V
C17 0.1 5% 16V
U5 TLC2201
NC
7
1
5
C40 0.1 5% 16V
C41 0.1 5% 16V
+5ISO
U12 DG413
V+
VL
GND
V-
13
12
5
4
C38 10 16V 20%
C37 0.1 5% 16V
C55 0.1 5% 16V
U17 LTC1290
AGND
DGND
20
11
10
12
C53 10 16V 20%
C54 0.1 5% 16V
+
F-SHIELD
+VISO
+5ISO

NOTE: Tie ISOAGND, ISOGND and FSHIELD planes together at pins 13 and 14 of U303. Tie +VISO plane to +5ISO plane near ISOAGND, FSHIELD and ISOGND connection.

8 of 9

LABEL	PAGE COORDINATES
+5:	6-B2,B3,B4,B6,C1,C6,D3,D5,D6
+5ISO:	1-C7,D2,D7 2-A6,B3,B7,C3,D2,D4 3-B1,B2 4-B7,C7,D7 5-A8,B6,C3,C5,D5 6-B8,C7,C8,D7,D8 7-A1,A5,B3
+VDD_SYN:	1-D8 2-A4
+VISO:	3-A4,C3,C4,D8 7-A1,B8
-.64VREF:	3-B5,B8 4-C8 5-A6
-4VREF:	3-B8,C5 5-B5,D8
-VISO:	3-A2,C2,C3 6-A8 7-A8,B8
2.5VREF:	3-D7 5-C8
332_FLOAT:	1-A8 2-C4
4.5VREF:	3-B8,D4
A-D_IR:	3-D2 4-C2
A-D_RED:	3-D2 4-C2
A0:	1-C3,C5 2-D6,D7
A1:	1-C3,C5 2-D6,D7
A2:	1-C3,C5 2-D6,D7
A3:	1-C3,C5 2-D6,D7
A4:	1-C3,C5 2-D6,D7
A5:	1-C3,C5 2-D6,D7
A6:	1-C3,C5 2-C6,D7
A7:	1-C3,C5 2-C6,C7
A8:	1-C3,C5 2-C6,C7
A9:	1-C3,C5 2-C6,C7
A10:	1-C3,D5 2-C6,C7
A11:	1-C3,D5 2-C6,C7
A12:	1-C2,D5 2-C6,C7
A13:	1-C2,D5 2-C6,C7
A14:	1-C2,D5 2-C6,C7
A15:	1-C2,D5 2-C6,C7
A16:	1-C2,D5 2-C6,C7
A17:	1-C2,D5
A18:	1-C2,D5 2-C7
ACK*:	6-C1
AD_ACLK:	1-B2 3-D4
BERR*:	1-A8,B2 2-C2
CAL_OK:	6-B4
D0:	1-B5,C4
D1:	1-B5,D2
D2:	1-B5,D2
D3:	1-B5,D2
D4:	1-B5,D2
D5:	1-B5,D2
D6:	1-B5,D3
D7:	1-B5,D3
D8:	1-C5,D4 2-C5,D6
D9:	1-C5,D4 2-C5,D6
D10:	1-C5,D3 2-C5,D6
D11:	1-C5,D3 2-C5,D6
D12:	1-C5,D3 2-C5,D6
D13:	1-C5,D3 2-C5,D6
D14:	1-C5,D3 2-C5,D6
D15:	1-C5,D3 2-C5,C6
DSCLK:	1-B7 2-D2
DSI:	1-B7 2-D2
DSO:	1-B7 2-D2
EXTAL:	1-A8 2-B6
FLASH_CS*:	1-B8 2-B8
FLASH_WR*:	1-B8 2-B8
FREEZE:	1-C7 2-D2
HALT*:	1-B8,C2
IBF:	6-C1
INTR:	6-C1
INT_DET:	6-C4
IR_ENBL*:	1-B3,C8 4-A5
IR_LED:	3-C2 4-B2
ISO-POWER_EN:	6-C4
ISOAGND:	6-A8
ISOGND:	6-B8
LED_GREEN:	1-D5 2-B8
LED_RED:	1-D5 2-A8
LOADDAC*:	1-A5,C2 4-C8 5-C8
LOW_SAT:	6-B4
LQ_SIG:	6-B4
MODCK:	1-B2,B8
NELLCOR*:	1-D5 5-A4
NEL_IR*:	1-C8 4-C5
NEL_RED*:	1-C8 4-C5
NO_PROBE:	6-B4
OBF*:	6-C1
OHM/NEL*:	1-B5 3-B1
PA0:	6-C1
PA1:	6-C1
PA2:	6-C1
PA3:	6-C1
PA4:	6-C1
PA5:	6-C1
PA6:	6-C1
PA7:	6-D1
POX:	3-D2 5-B1
POX+:	3-C2 5-D8
POX-:	3-C3 5-D8
POX_CLR*:	1-A5,B2 4-C8 5-C8
POX_CTRL0:	1-B4,C8 5-B3
POX_CTRL1:	1-B4,C8 5-B3
POX_EN*:	1-B8 4-D8
POX_ID:	3-C2 5-A1
POX_ID0:	1-D1,D8
POX_ID1:	1-D1,D8
POX_PINT:	3-D2 5-C1
POX_PREAC:	3-D2 5-D1
POX_PWR:	3-C2 4-D2
POX_SUM:	3-C2 5-C1
PRB_SENSE*:	1-B5 3-B1
PROBE_OFF:	6-B4
PULSE:	6-B4
RD/WR*:	1-B4 2-B8
RED_ENBL*:	1-B4,C8 4-B5
RED_LED:	3-B2 4-C2

9 of 9

LABEL	PAGE COORDINATES
RESET*:	1-B8 2-B1,C2
RESTORE*:	1-A5 5-D5
RSENSE:	3-B2 5-A6
RXD_ISO:	1-C8 6-D8
SP02_RESET*:	6-B2
SPARE:	6-C4
SPI_CS0*:	1-C8 3-D4
SPI_CS1*:	1-C8 5-A8
SPI_CS2*:	1-C8 5-C8
SPI_CS3*:	1-C8 4-B8
SPI_MISO:	1-C8 3-D4
SPI_MOSI:	1-C8 3-D4 4-C8 5-C8
SPI_SCLK:	1-C8 3-D4 4-B8 5-C8
SRAM_CS*:	1-B8 2-C8
SRAM_CS2:	1-B2 2-C8
STB*:	6-C1
TEST_MODE*:	6-C4
TXD_ISO:	1-C8 6-C8
WR/RD*:	1-A4 2-B8
XTAL:	1-A8 2-B6

REFDES	PAGE COORDINATES
U1:	4-D6
U2:	4-C3 7-B5
U3:	4-C5,C6 7-B6
U4:	5-D4,D5 7-B4
U5:	5-D7 7-B6
U6:	3-D8
U7:	3-B6,C6 7-B7
U8:	5-C2,C4 7-B3
U9:	5-C6,C7,C8,D7
U10:	5-B7,C6 7-B4
U11:	5-A4,C7 7-B7
U12:	5-B3 7-B5
U13:	3-D6 5-B2 7-B2
U14:	4-C7
U15:	5-C5
U16:	5-B8
U17:	3-D3 7-B4
U18:	1-C3
U19:	1-A4 2-A7,B8 7-C5,C6,C7,C8
U20:	1-B3 7-C3,C8
U21:	1-C3
U22:	1-D3
U23:	2-D5 7-C8
U24:	1-D7 7-C8
U25:	2-B2
U26:	2-D7 7-C8
U27:	6-D7
U28:	6-C7

REFDES	PAGE COORDINATES
U29:	6-D5 7-D8
U30:	6-D2 7-D8
U31:	6-B7
U32:	6-D4
U33:	3-A4

CONNECTOR	SIGNAL
J1-17:	06030065
J1-18:	06054054
J1-19:	06030065
J1-20:	06054054
J1-25:	TEST_MODE*
J1-28:	PA7
J1-30:	PA6
J1-32:	PA5
J1-34:	PA4
J1-36:	PA3
J1-38:	PA2
J1-40:	PA1
J1-41:	SP02_RESET*
J1-42:	PA0
J1-43:	PULSE
J1-44:	OBF*
J1-45:	INT_DET
J1-46:	ACK*
J1-47:	CAL_OK
J1-48:	IBF
J1-49:	SPARE
J1-50:	STB*
J1-51:	LQ_SIG
J1-53:	NO_PROBE
J1-55:	PROBE_OFF
J1-57:	LOW_SAT
J1-61:	+5
J1-62:	+5
J1-63:	GND
J1-64:	GND

CONNECTOR	SIGNAL
J2-1:	POX-
J2-2:	POX+
J2-3:	POX-
J2-4:	FSHIELD
J2-5:	POX_PWR
J2-6:	FSHIELD
J2-7:	IR_LED
J2-8:	FSHIELD
J2-9:	RED_LED
J2-10:	FSHIELD
J2-11:	RSENSE
J2-12:	FSHIELD
J2-13:	03067043
J2-14:	FSHIELD
J2-15:	03067046
J2-16:	FSHIELD
J2-17:	03067053
J2-18:	FSHIELD
J2-19:	ISOGND
J2-20:	FSHIELD
J3-2:	BERR*
J3-3:	ISOGND
J3-4:	DSCLK
J3-5:	ISOGND
J3-6:	FREEZE
J3-7:	RESET*
J3-8:	DSI
J3-9:	02086029
J3-10:	DSO
J4-1:	ISOAGND
J4-2:	-4VREF
J4-3:	-.64VREF
J4-4:	4.5VREF

Assembly Revisions PN 800674

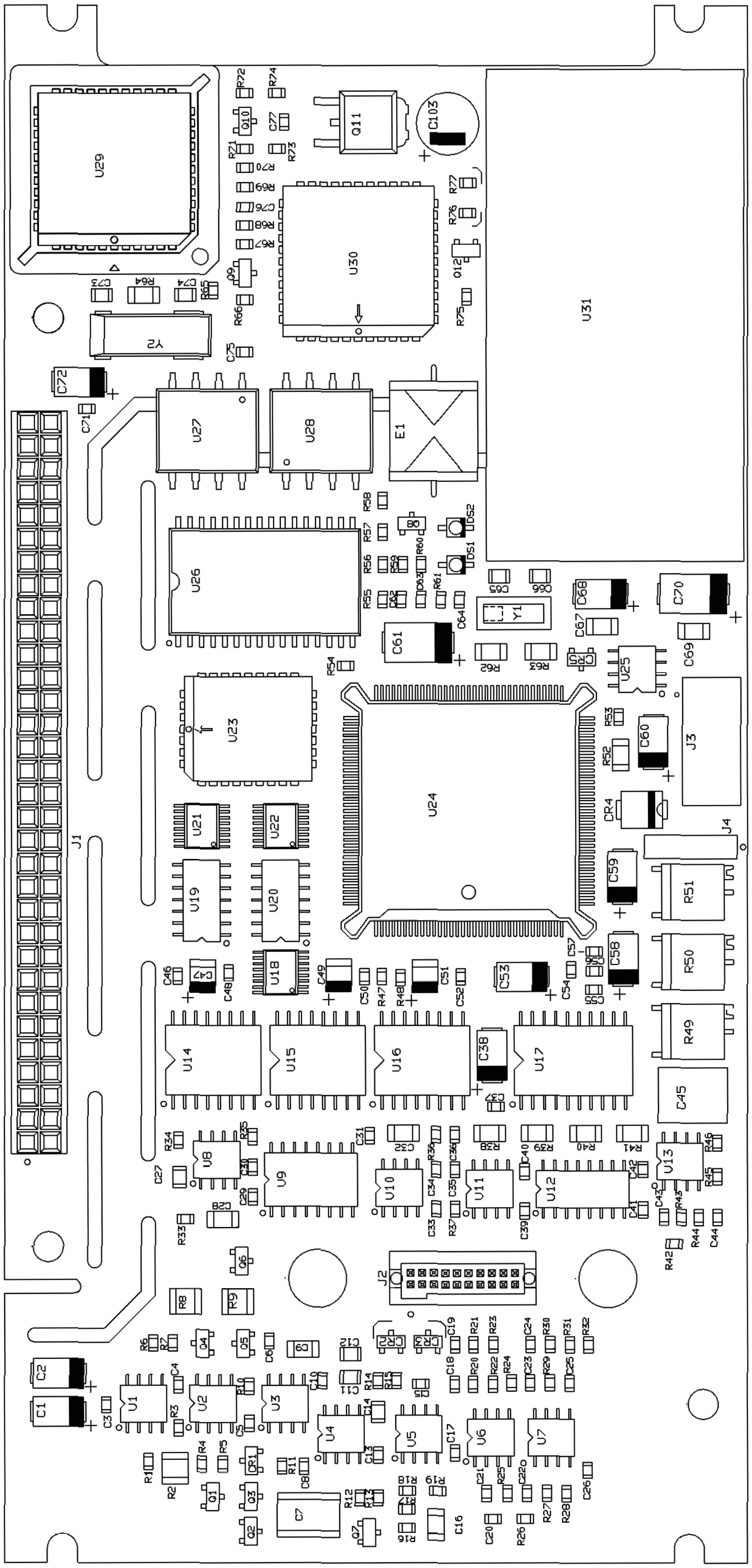
The current baseline revision for this assembly is pn 800674-003A. Earlier versions of this assembly are presented later in this chapter. To convert the parts list, pn 800674-001A/002B, back to a previous revision, change all part numbers, descriptions, and quantities as indicated in the revision tables given below.

PN 800674-001A

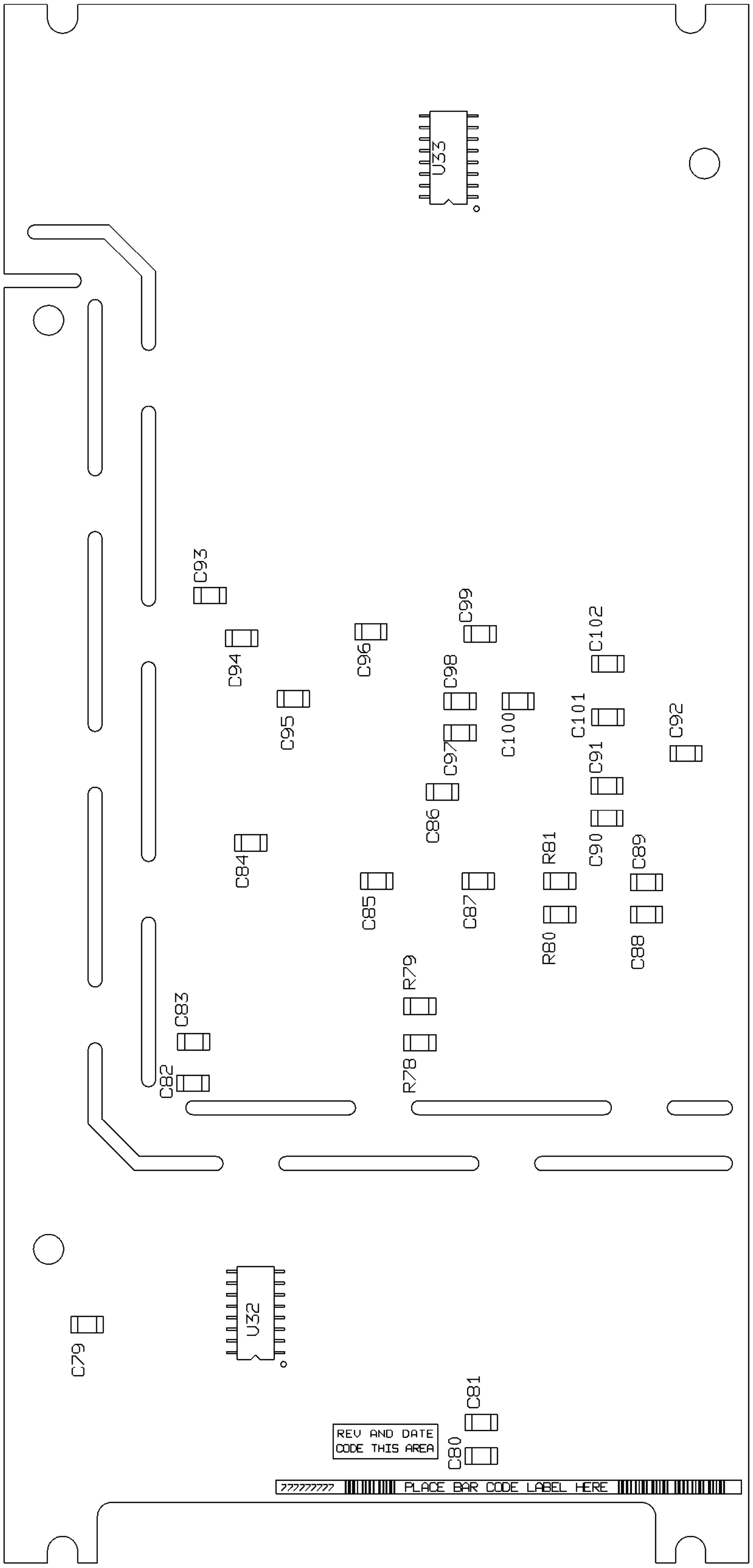
Reference Designation	Description	Revision's Part Number	Baseline Part Number	Qty
U23	EEPROM, Flash Memory, Tram SpO_2	414474-001	414474-003	1
Use SD800674-002 schematic diagram except for U29 and Y2 are different as noted in this parts list.)				

Parts Location Diagram PN 800674-001A/002B

1 of 2


U29
R72
R74
Q10
C77
R71
R73
Q11
C103
R70
R69
C76
R68
R67
R77
R76
U30
Q12
Q9
R66
R75
U31
C73
R64
C74
R65
Y2
C75
C72
C71
U27
U28
E1
R58
R57
R56
R55
DS2
DS1
R60
R59
R61
C63
C62
C64
U26
C65
C66
C68
C70
Y1
C67
C61
R62
R63
C69
R54
U25
U23
U24
R53
C60
R52
J3
CR4
J4
J1
U21
U22
U19
U20
C59
R51
C57
C58
R50
U18
C46
C47
C48
C49
C50
R47
R48
C51
C52
C53
C54
C55
C56
R49
U14
U15
U16
C38
U17
C37
C45
R34
R35
C31
C32
R36
C36
R38
C40
R39
R40
R41
R46
U8
U9
U10
U11
U12
U13
C27
C30
C29
C34
C35
C42
C43
R43
R45
C28
C33
R37
C39
C41
R44
C44
R33
R42
Q6
J2
R8
R9
R6
R7
Q4
Q5
C6
C9
C12
CR2
CR3
C19
R21
R23
C24
R30
R31
R32
C18
R20
R22
R24
C23
R29
C25
C2
C4
C10
C11
R14
R15
C15
C1
C3
U1
R3
U2
R10
U3
C14
C13
U4
U5
C17
U6
U7
C5
R4
R5
QR1
R11
C8
R1
R2
R18
R19
C21
R25
C22
C26
Q1
Q3
C7
R12
R13
R17
R27
R28
Q2
Q7
R16
C16
C20
R26

2 of 2


U33
C93
C94
C96
C99
C102
C98
C95
C100
C101
C92
C97
C91
C86
C84
R81
C90
C89
C85
C87
R80
C88
R79
C83
R78
C82
U32
C79
C81
C80
REV AND DATE CODE THIS AREA
PLACE BAR CODE LABEL HERE

Parts List PN 800674-001A/002B

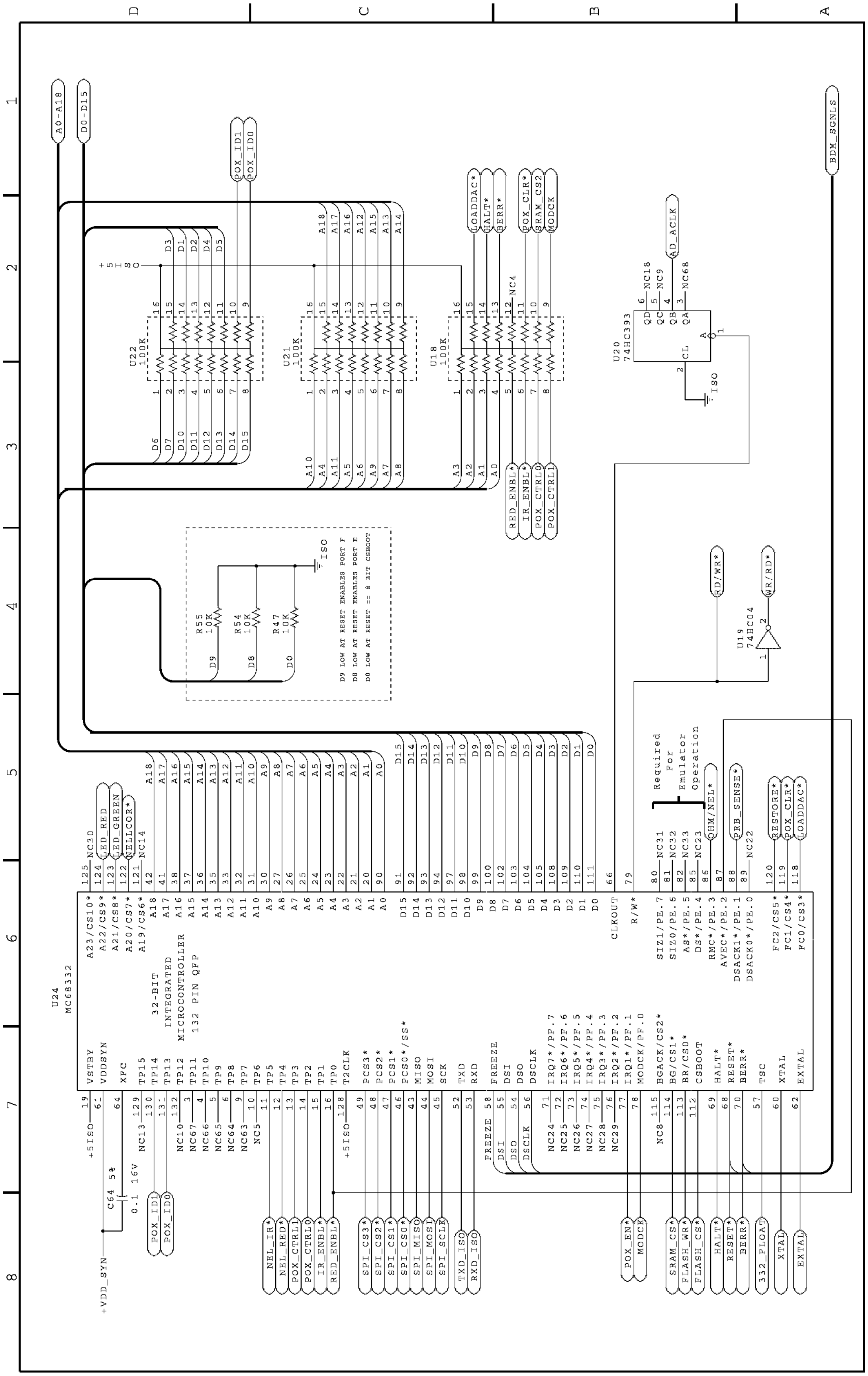
Item	Parts List	Part Number	Qty
C1, 2, 38, 53, 58-60, 68, 72	Cap, Tant, 10µF, 20%, 16V, SM	1176-106	9
C3, 20, 22, 24, 25, 34, 36, 43, 46, 48, 50, 52, 57, 62, 71, 77	Cap, Cer, 0.1µF, 5%, 50V	411575-012	16
C4-6, 8, 10, 13, 15, 17-19, 21, 23, 26, 29-31, 33, 35, 37, 39, 40-42, 44, 54-56, 63, 64, 75, 76	Cap, Cer, 0.1µF, 5%, 16V	411575-002	31
C7	Cap, Cer, 0.33µF, 5%, 50V	1181-334	1
C9, 28, 32	Cap, Cer, 0.0015µF, 5%, SM	1181-152	3
C11	Cap, Cer, 470pF, 5%, 50V, SM	1181-471	1
C12	Cap, Cer, 0.001µF, 5%, 50V, SM	1181-102	1
C14, 65, 66, 73, 74	Cap, Cer, 22pF, 5%, 50V, SM	1181-220	5
C16	Cap, Cer, 0.1µF, 5%, 50V, SM	1182-104	1
C27	Cap, Cer, 150pF, 5%, 50V, SM	1181-151	1
C45	Cap, PP, 0.01µF, 1%, 63V	408822-001	1
C47, 49, 51	Cap, Tant, 1.0µF, 10%, 35V, SM	403907-001	3
C61	Cap, Tant, 47µF, 20%, 10V, SM	405585-001	1
C70	Cap, Tant, 22µF, 10%, 25V, SM	407653-001	1
C67, 69, 79, 81-87, 89-102	Cap, Cer, 0.1µF, 20%, 50V	404370-001	24
C80, 88	Cap, Cer, 0.01µF, 5%, 50V, SM	400265-001	2
C103	Cap, Al, 100µF, 20%, 25V	401722-001	1
CR1	Diode, SM MMAD4148	401980-001	1
CR2, 3	Diode, SM FDSO1503	2414-001	2
CR4	Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3	403187-001	1
CR5	Diode, Schottky, SM BAT54	401985-001	1
DS1	Diode, Light-Emitting (Green)	401429-003	1
DS2	Diode, Light-Emitting (Red)	401429-001	1
E1	Surge Protector, 7.5kV, ±15%	1931-001	1
J1	Connector, PC Header, 64-Pin	1847-064	1
J2	Connector, PC Header, 20-Pin, SM	413053-002	1
J3	PC Post, 2 x 5-Pin	413864-001	1
J4	PC Post, 1 x 4-Pin	413864-002	1
Q1, 4	Transistor, PNP, SM T2907A	405759-001	2
Q2, 5	Transistor, NPN, SM MMBT222	404927-001	2
Q3, 6	Transistor, MOSFET, N-Channel, Enhancement Mode, SM VN0605T	406267-001	2
Q7	Transistor, JFET, P-Channel, SM MMBFJ117	404417-001	1
Q8, 9	Transistor, PNP, SM T3906	2511-101	2
Q10, 12	Transistor, NPN, SM T3904	2511-001	2

Item	Parts List	Part Number	Qty
Q11	Transistor, HEXFET, P-Channel, 25W, SM IRFR9010TR	406513-001	1
R1, 7, 48	Res, Cer, 100K, 1%, 1/16W, SM	410334-019	3
R2, 8, 9	Res, Cer, 10.0K, 1%, 1/4W	407468-002	3
R3, 11, 20-23, 27, 28, 30, 32, 43, 47, 53-55, 57, 60, 65, 68-77	Res, Cer, 10K, 1%, 1/16W, SM	410334-013	28
R4-6, 10	Res, Cer, 4.75K, 1%, 1/16W, SM	410334-010	4
R12	Res, Cer, 475Ω, 1%, 1/16W, SM	410334-064	1
R13	Res, Cer, 499K, 1%, 1/16W, SM	410334-072	1
R14, 15	Res, Cer, 23.2K, 1%, 1/16W, SM	410334-069	2
R16, 17, 34	Res, Cer, 301K, 1%, 1/16W, SM	410334-071	3
R18, 19, 56	Res, Cer, 1K, 1%, 1/16W, SM	410334-008	3
R24	Res, Cer, 150Ω, 1%, 1/16W, SM	410334-028	1
R25, 29, 42, 61	Res, Cer, 100Ω, 1%, 1/16W, SM	410334-003	4
R26	Res, Cer, 16.5K, 1%, 1/16W, SM	410334-068	1
R31	Res, Cer, 38.3K, 1%, 1/16W, SM	410334-047	1
R33, 35	Res, Cer, 3.01K, 1%, 1/16W, SM	410334-018	2
R36	Res, Cer, 2K, 1%, 1/16W, SM	410334-009	1
R37	Res, Cer, 4.99K, 1%, 1/16W, SM	410334-066	1
R38	Res, Cer, 200K, 0.1%, 1/8W, SM	1067-832	1
R39	Res, Cer, 38.8K, 0.1%, 1/8W, SM	1067-388	1
R40	Res, Cer, 248K, 0.1%, 1/8W, SM	1067-249	1
R41	Res, Cer, 178K, 0.1%, 1/8W, SM	1067-849	1
R44	Res, Cer, 11.5K, 1%, 1/16W, SM	410334-014	1
R45, 46	Res, Cer, 75K, 1%, 1/16W, SM	410334-063	2
R49, 50, 51	Res, Var, 2K, Side Adjust, SM	409023-003	3
R52	Res, Cer, 1.5K, 1%, 1/8W, SM	1082-768	1
R58, 66	Res, Cer, 681Ω, 1%, 1/16W, SM	410334-065	2
R59, 67	Res, Cer, 8.66K, 1%, 1/16W, SM	410334-067	2
R62	Res, Cer, 20M, 1%, 1/8W, SM	1081-510	1
R63	Res, Cer, 332K, 1%, 1/8W, SM	1082-874	1
R64	Res, Cer, 10M, 5%, 1/8W, SM	1081-106	1
R78, 79	Res, 340 Ω, 1%, 1/8W, SM	1082-790	2
R80, 81	Res, Cer, 10K, 1%, 1/8W, SM	1082-104	2
U1	Volt Rgltr, Adj, SM LP2951A	3076-001	1
U2-4, 7, 8, 10, 11, 13	Operational Ampl, Dual, SM TLC2272	412809-001	8
U5	Operational Ampl, SM TLC2201	403385-002	1
U6	Voltage Reference, 2.5V, SM AD680	410736-001	1
U9	Res, Ntwk, 10K, 0.1%, SM	405134-001	1
U12	Analog Switch, SPST, CMOS, Quad DG413	408821-001	1
U14-16	DAC, 12-Bit, SM 7543	405439-001	3
U17	Data Acquisition, SM LTC1290	405948-002	1
U18, 21, 22	Res, Ntwk, 100K	1049-203	3
U19	Inverter, Hex, SM HC04	3038-004	1

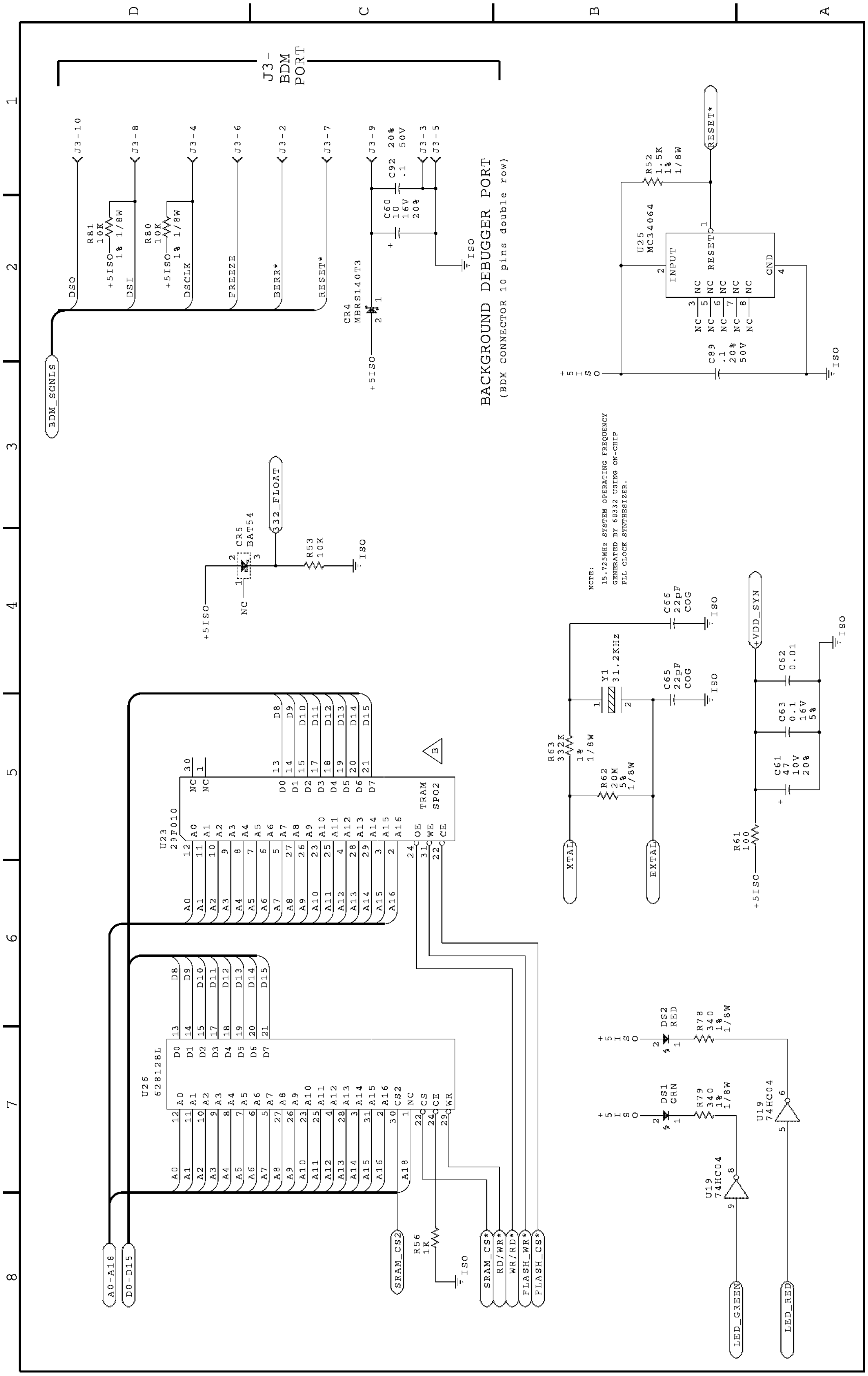
Item	Parts List	Part Number	Qty
U20	Counter, Binary, 4-Bit, Dual, SM HC393	3038-393	1
U23	EEPROM, Flash Memory, Tram SpO_2 (For -001 Only)	414474-001	1
U23	EEPROM, Flash Memory, Tram SpO_2 (For -002 Only)	414474-003	1
U24	Microcontroller, 16-MHz, SM 68332	408794-001	1
U25	Sensor, Undervoltage, 4.6V, SM MC34064D5	408952-001	1
U26	RAM, Static, 128K x 8-Bit, 70nS, SM 628128	406255-002	1
U27, 28	Isolator, Optically Coupled, SM 2611	408825-001	2
U29	EPROM, Tram SpO_2 Communication	414443-001	1
U30	Programmable Peripheral Interface, PLCC 82C55A	404697-001	1
U31	Converter, DC-to-DC, Isolated, ±5V	413655-002	1
U32	Res Ntwk, 100K, SM	1061-104	1
U33	Diode Pair Array, ESD/Overvoltage Protection, SM	412586-001	1
Y1	Crystal, 31.2kHz, SM	408946-001	1
Y2	Crystal Oscillator, 2.4576-MHz, SM (For -001 Only)	411514-001	1
Y2	Crystal Oscillator, 3.6864-MHz, SM (For -002 Only)	408828-001	1
-	Socket, PLCC, 44-Pin, SM (For U29)	402412-001	1
-	Circuit Board (For -001 Only)	800675-001A	1
-	Circuit Board (For -002 Only)	800675-002A	1
-	Schematic Diagram (For -001 Only; Use -002 schematic diagram except for U29 and Y2 are different as noted in this parts list.)	SD8000674-001A	
-	Schematic Diagram (For -002 Only)	SD8000674-002A	

Schematic Diagram PN SD800674-002A

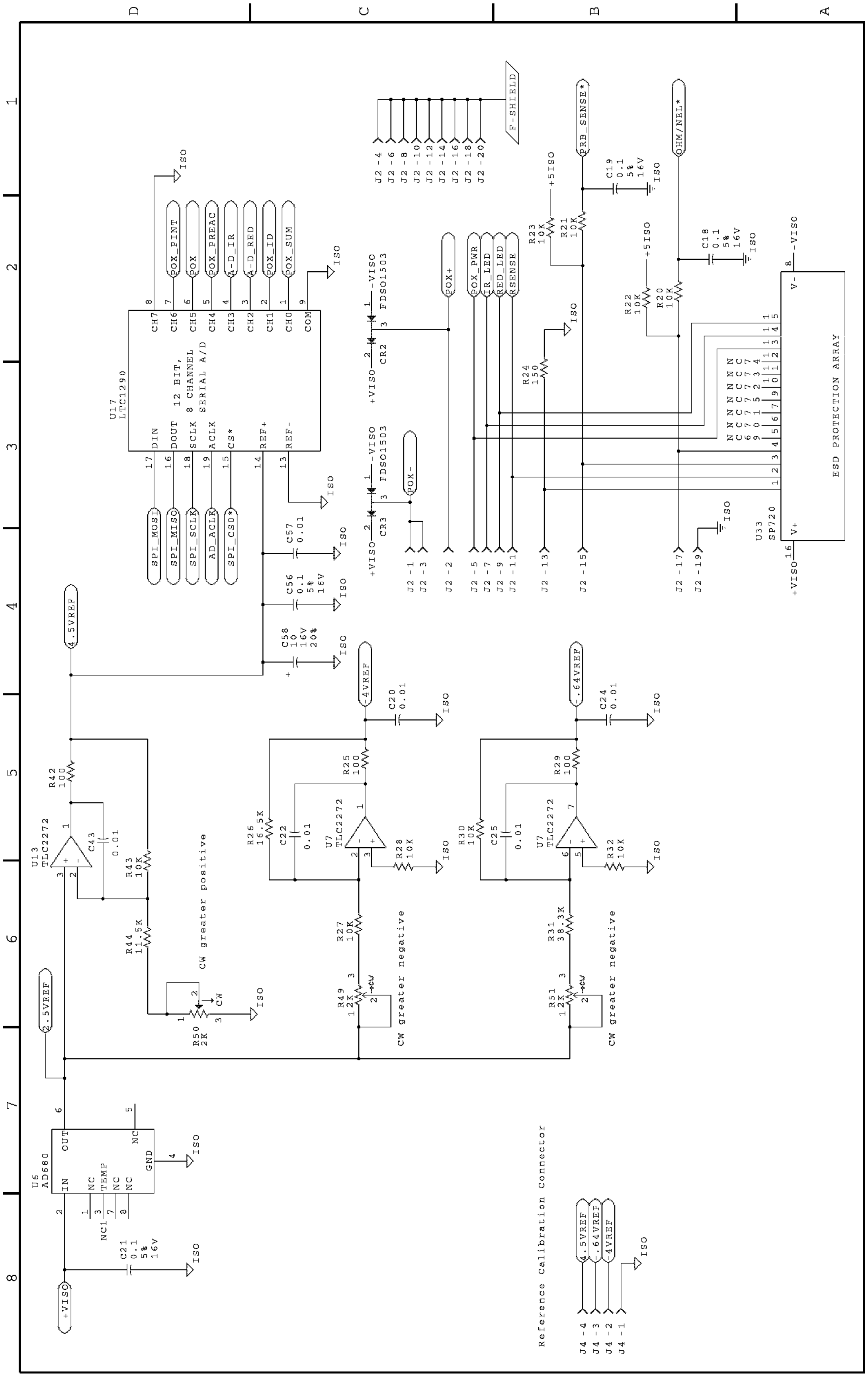
1 of 9


D
C
B
A
1
2
3
4
5
6
7
8
A0-A18
D0-D15
POX_ID1
POX_ID0
LOADDAC*
HALT*
BERR*
POX_CLR*
SRAM_CS2
MODCK
AD_ACLK
BDM_SGNLS
U22
100K
U21
100K
U18
100K
U20
74HC393
QD
QC
QB
QA
CL
A
NC18
NC9
NC68
NC4
ISO
+5ISO
RED_ENBL*
IR_ENBL*
POX_CTRL0
POX_CTRL1
R55 10K
R54 10K
R47 10K
D9 LOW AT RESET ENABLES PORT F
D8 LOW AT RESET ENABLES PORT E
D0 LOW AT RESET == 8 BIT CSBOOT
RD/WR*
WR/RD*
U19
74HC04
Required For Emulator Operation
OHM/NEL*
PRB_SENSE*
RESTORE*
POX_CLR*
LOADDAC*
NC30
LED_RED
LED_GREEN
NELLCOR*
NC14
NC31
NC32
NC33
NC23
NC22
U24
MC68332
32-BIT INTEGRATED MICROCONTROLLER
132 PIN QFP
A23/CS10*
A22/CS9*
A21/CS8*
A20/CS7*
A19/CS6*
CLKOUT
R/W*
SIZ1/PE.7
SIZ0/PE.6
AS*/PE.5
DS*/PE.4
RMC*/PE.3
AVEC*/PE.2
DSACK1*/PE.1
DSACK0*/PE.0
FC2/CS5*
FC1/CS4*
FC0/CS3*
VSTBY
VDDSYN
XPC
TP15
TP14
TP13
TP12
TP11
TP10
TP9
TP8
TP7
TP6
TP5
TP4
TP3
TP2
TP1
TP0
T2CLK
PCS3*
PCS2*
PCS1*
PCS0*/SS*
MISO
MOSI
SCK
TXD
RXD
FREEZE
DSI
DSO
DSCLK
IRQ7*/PF.7
IRQ6*/PF.6
IRQ5*/PF.5
IRQ4*/PF.4
IRQ3*/PF.3
IRQ2*/PF.2
IRQ1*/PF.1
MODCK/PF.0
BGACK/CS2*
BG/CS1*
BR/CS0*
CSBOOT
HALT*
RESET*
BERR*
TSC
XTAL
EXTAL
C64 5%
0.1 16V
+VDD_SYN
NC13
NC10
NC67
NC66
NC65
NC64
NC63
NC5
NC24
NC25
NC26
NC27
NC28
NC29
NC8
NEL_IR*
NEL_RED*
POX_CTRL1
POX_CTRL0
IR_ENBL*
RED_ENBL*
SPI_CS3*
SPI_CS2*
SPI_CS1*
SPI_CS0*
SPI_MISO
SPI_MOSI
SPI_SCLK
TXD_ISO
RXD_ISO
POX_EN*
MODCK
SRAM_CS*
FLASH_WR*
FLASH_CS*
HALT*
RESET*
BERR*
332_FLOAT
XTAL
EXTAL

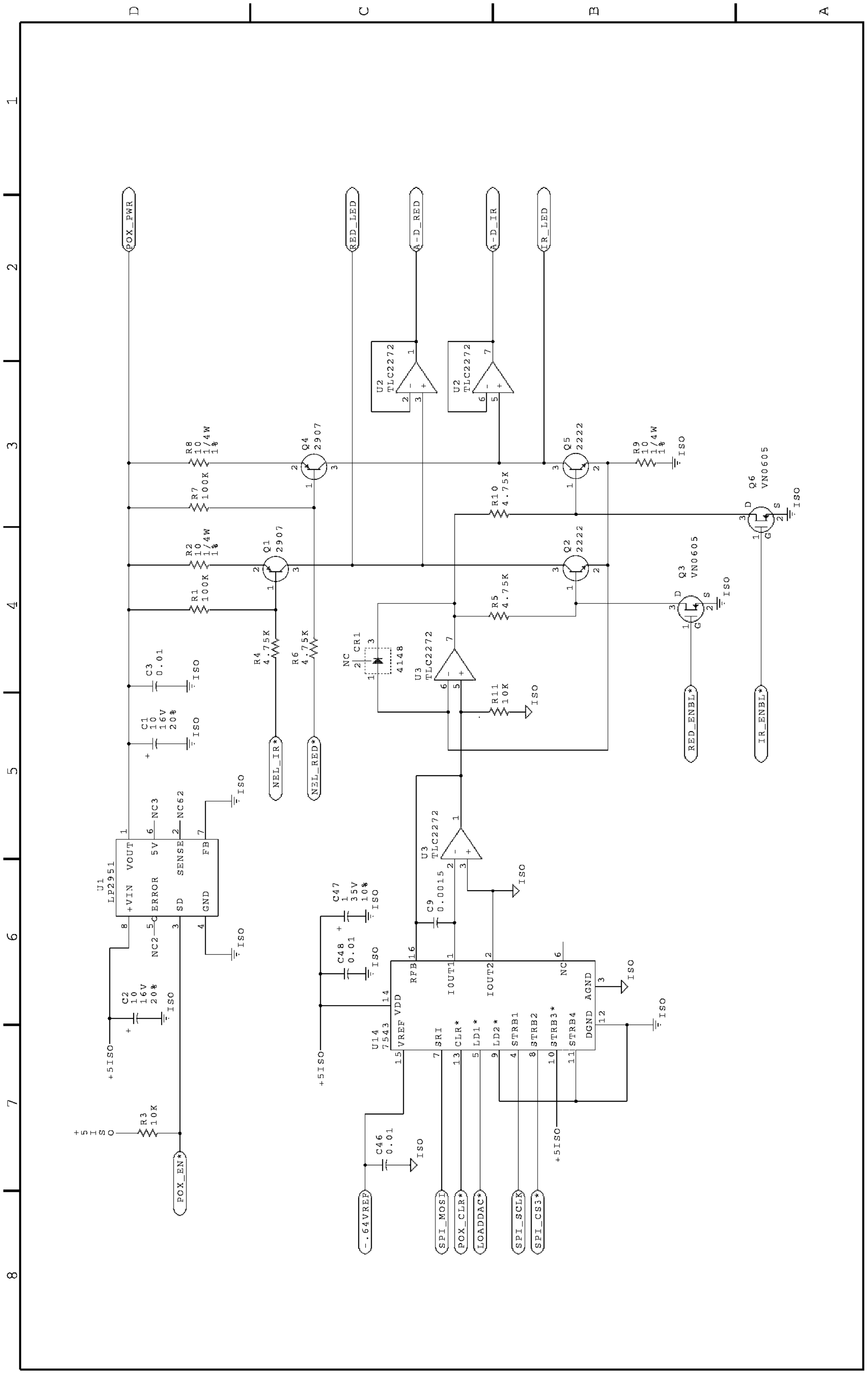
2 of 9


D
C
B
A
1
2
3
4
5
6
7
8
J3-
BDM
PORT
J3-10
J3-8
J3-4
J3-6
J3-2
J3-7
J3-9
J3-3
J3-5
R81
10K
1% 1/8W
+5ISO
R80
10K
1% 1/8W
+5ISO
DSO
DSI
DSCLK
FREEZE
BERR*
RESET*
BDM_SGNLS
C92
.1
20%
50V
C60
10
16V
20%
ISO
CR4
MBRS140T3
+5ISO
BACKGROUND DEBUGGER PORT
(BDM CONNECTOR 10 pins double row)
R52
1.5K
1%
1/8W
RESET*
U25
MC34064
INPUT
RESET
GND
NC
C89
.1
20%
50V
+5ISO
ISO
NOTE:
15.725MHz SYSTEM OPERATING FREQUENCY
GENERATED BY 68332 USING ON-CHIP
PLL CLOCK SYNTHESIZER.
332_FLOAT
CR5
BAT54
R53
10K
ISO
+5ISO
NC
C66
22pF
COG
Y1
31.2KHz
C65
22pF
COG
ISO
R63
332K
1%
1/8W
R62
20M
5%
1/8W
XTAL
EXTAL
VDD_SYN
C62
0.01
C63
0.1
16V
5%
C61
47
10V
20%
R61
100
+5ISO
ISO
U23
29F010
TRAM
SP02
B
A0–A16
D0–D7
D8–D15
OE
WE
CE
NC
U26
628128L
CS2
CS
OE
WR
A18
SRAM_CS2
R56
1K
ISO
SRAM_CS*
RD/WR*
WR/RD*
FLASH_WR*
FLASH_CS*
A0-A18
D0-D15
DS2
RED
R78
340
1%
1/8W
DS1
GRN
R79
340
1%
1/8W
+5ISO
U19
74HC04
LED_GREEN
LED_RED

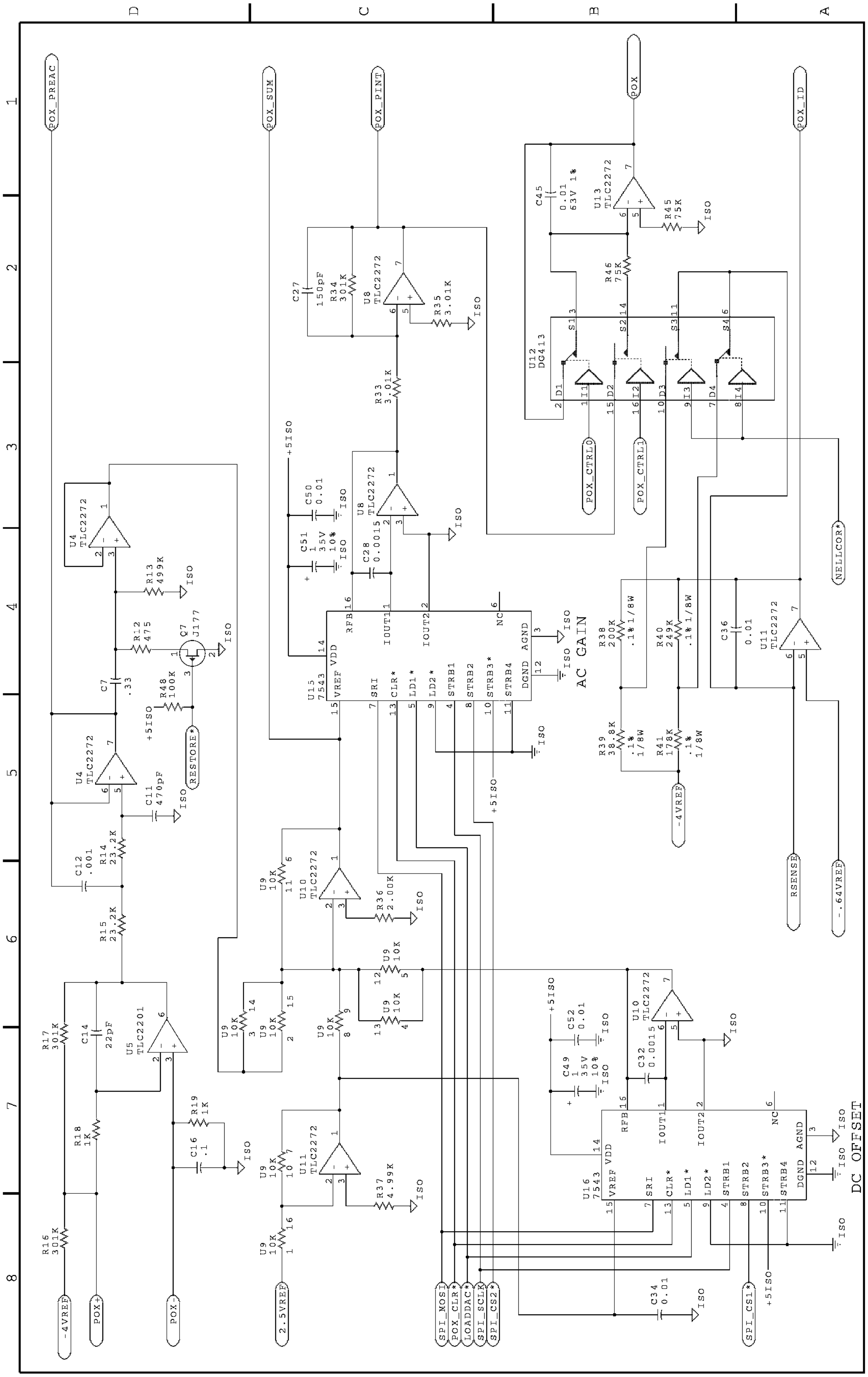
3 of 9


D
C
B
A
1
2
3
4
5
6
7
8
U17
LTC1290
12 BIT,
8 CHANNEL
SERIAL A/D
CH7
CH6
CH5
CH4
CH3
CH2
CH1
CH0
COM
DIN
DOUT
SCLK
ACLK
CS*
REF+
REF-
POX_PINT
POX
POX_PREAC
A-D_IR
A-D_RED
POX_ID
POX_SUM
SPI_MOSI
SPI_MISO
SPI_SCLK
AD_ACLK
SPI_CS0*
ISO
C57
0.01
C56
0.1
5%
16V
C58
10
16V
20%
4.5VREF
F-SHIELD
J2-4
J2-6
J2-8
J2-10
J2-12
J2-14
J2-16
J2-18
J2-20
-VISO
+VISO
CR2
CR3
FDSO1503
POX+
POX-
POX_PWR
IR_LED
RED_LED
RSENSE
J2-1
J2-3
J2-2
J2-5
J2-7
J2-9
J2-11
J2-13
J2-15
J2-17
J2-19
PRB_SENSE*
OHM/NEL*
+5ISO
R23
10K
R21
10K
C19
0.1
5%
16V
C18
0.1
5%
16V
R22
10K
R20
10K
R24
150
U33
SP720
ESD PROTECTION ARRAY
V+
V-
NC
-4VREF
C20
0.01
R25
100
R26
16.5K
C22
0.01
U7
TLC2272
R28
10K
R27
10K
R49
12K
CW greater negative
-.64VREF
C24
0.01
R29
100
R30
10K
C25
0.01
R32
10K
R31
38.3K
R51
12K
R42
100
U13
TLC2272
C43
0.01
R43
10K
R44
11.5K
R50
2K
CW greater positive
CW
2.5VREF
U6
AD680
IN
OUT
NC
TEMP
GND
C21
0.1
5%
16V
+VISO
Reference Calibration Connector
J4-4
J4-3
J4-2
J4-1

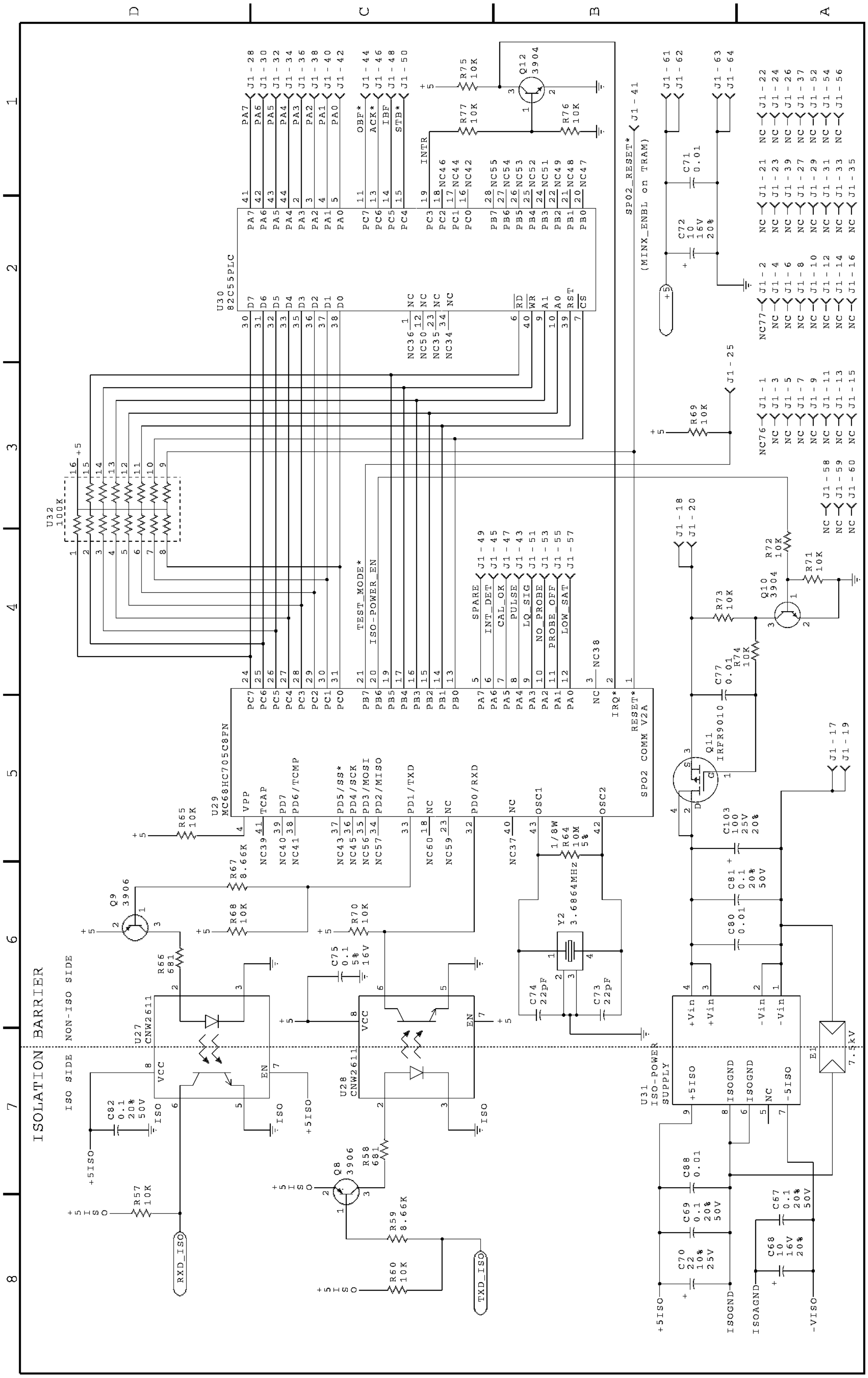
4 of 9


POX_PWR
RED_LED
A-D_RED
A-D_IR
IR_LED
U2 TLC2272
U3 TLC2272
U1 LP2951
+VIN
VOUT
ERROR
5V
SD
SENSE
GND
FB
NC2
NC3
NC62
R8 10 1/4W 1%
R7 100K
R2 10 1/4W 1%
R1 100K
R9 10 1/4W 1%
R10 4.75K
R5 4.75K
R4 4.75K
R6 4.75K
R11 10K
R3 10K
Q4 2907
Q1 2907
Q5 2222
Q2 2222
Q6 VN0605
Q3 VN0605
CR1 4148
NC
C3 0.01
C1 10 16V 20%
C2 10 16V 20%
C47 1 35V 10%
C48 0.01
C9 0.0015
C46 0.01
U14 7543
VREF
VDD
RFB
IOUT1
IOUT2
NC
AGND
DGND
SRI
CLR*
LD1*
LD2*
STRB1
STRB2
STRB3*
STRB4
ISO
+5ISO
NEL_IR*
NEL_RED*
RED_ENBL*
IR_ENBL*
POX_EN*
-.64VREF
SPI_MOSI
POX_CLR*
LOADDAC*
SPI_SCLK
SPI_CS3*
A
B
C
D
1
2
3
4
5
6
7
8

5 of 9


D
C
B
A
1
2
3
4
5
6
7
8
POX_PREAC
POX_SUM
POX_PINT
POX
POX_ID
U4 TLC2272
U5 TLC2201
U8 TLC2272
U10 TLC2272
U11 TLC2272
U13 TLC2272
U12 DG413
U15 7543
U16 7543
AC GAIN
DC OFFSET
Q7 J177
RESTORE*
POX_CTRL0
POX_CTRL1
NELLCOR*
RSENSE
-.64VREF
-4VREF
POX+
POX-
2.5VREF
SPI_MOSI
POX_CLR*
LOADDAC*
SPI_SCLK
SPI_CS2*
SPI_CS1*
+5ISO
ISO

6 of 9


D
C
B
A
1
2
3
4
5
6
7
8
U30
82C55PLC
U29
MC68HC705C8FN
SPO2 COMM V2A
U32
100K
U27
CNW2611
U28
CNW2611
U31
ISO-POWER
SUPPLY
Q9
3906
Q8
3906
Q10
3904
Q11
IRFR9010
Q12
3904
Y2
3.6864MHz
ISOLATION BARRIER
ISO SIDE
NON-ISO SIDE
RXD_ISO
TXD_ISO
SPO2_RESET*
(MINX_ENBL on TRAM)
TEST_MODE*
ISO-POWER_EN
SPARE
INT_DET
CAL_OK
PULSE
LQ_SIG
NO_PROBE
PROBE_OFF
LOW_SAT
OBF*
ACK*
IBF
STB*
INTR
E1
7.5kV
+5ISO
ISOGND
ISOAGND
-VISO

7 of 9

IC POWER/RETURN CHART				POWER SUPPLY BYPASS			
IC		POWER	RETURN	REFD	VALUE	PWR	RTN
U29	68HC705	44	22	C79	0.1	+5	GND
U30	82C55PLC	29	8	C76	0.1	+5	GND

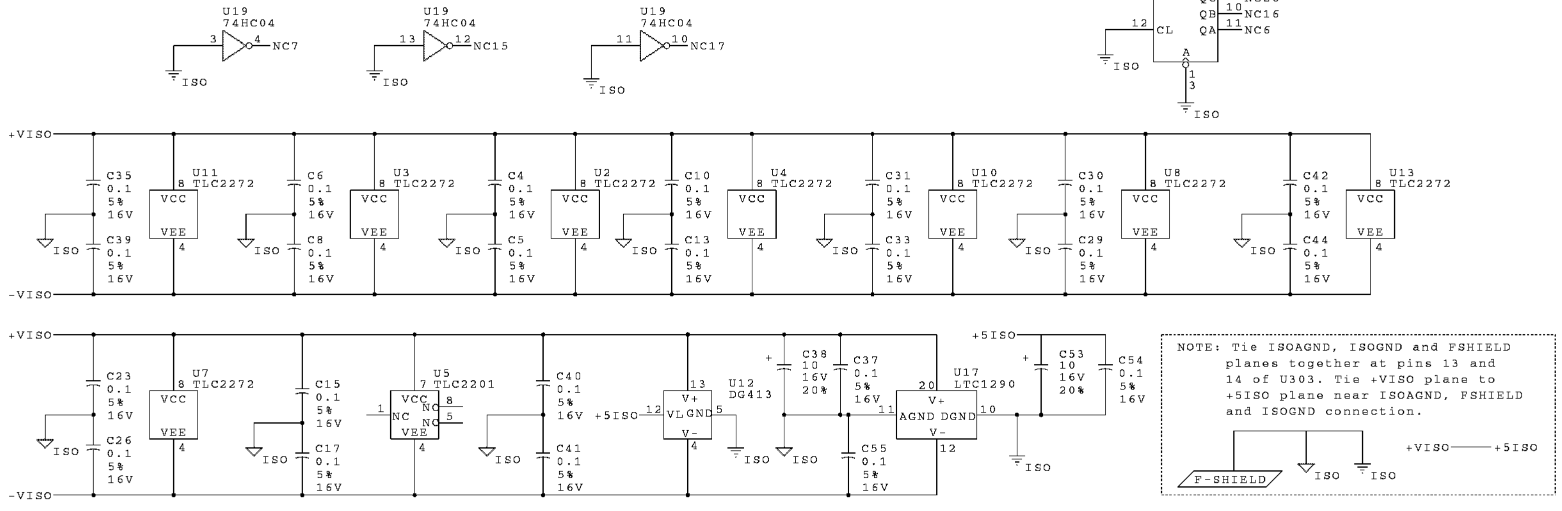
ISOLATION BARRIER

Non-iso Side

Iso Side

IC POWER/RETURN CHART				POWER SUPPLY BYPASS				POWER SUPPLY BYPASS				POWER SUPPLY BYPASS			
IC		POWER	RETURN	REFD	VALUE	PWR	RTN	REFD	VALUE	PWR	RTN	REFD	VALUE	PWR	RTN
U24	MC68332	1,7,18,28,39, 50,63,65,84, 96,107,116,126	2,8,17,29,40,51 59,67,83,95,101 106,117,127,34	C59	10*	+5ISO	ISOGND	C86	.1	+5ISO	ISOGND	C101	.1	+5ISO	ISOGND
				C95	.1	+5ISO	ISOGND	C91	.1	+5ISO	ISOGND	C102	.1	+5ISO	ISOGND
				C96	.1	+5ISO	ISOGND	C100	.1	+5ISO	ISOGND				
				C87	.1	+5ISO	ISOGND	C90	.1	+5ISO	ISOGND				
				C85	.1	+5ISO	ISOGND	C99	.1	+5ISO	ISOGND				
				C98	.1	+5ISO	ISOGND	C97	.1	+5ISO	ISOGND				
U19	74HC04	14	7	C93	.1	+5ISO	ISOGND								
U26	628128L	32	16	C83	.1	+5ISO	ISOGND								
U23	29F010-70	32	16	C84	.1	+5ISO	ISOGND								
U20	74HC393	14	7	C94	.1	+5ISO	ISOGND								

* 16V,20%


U19
74HC04
3
4
NC7
ISO
U19
74HC04
13
12
NC15
ISO
U19
74HC04
11
10
NC17
ISO
U20
74HC393
QD 8 NC19
QC 9 NC20
QB 10 NC16
QA 11 NC6
12 CL
A 1 3
ISO
+VISO
-VISO
C35 0.1 5% 16V
C39 0.1 5% 16V
U11 TLC2272
C6 0.1 5% 16V
C8 0.1 5% 16V
U3 TLC2272
C4 0.1 5% 16V
C5 0.1 5% 16V
U2 TLC2272
C10 0.1 5% 16V
C13 0.1 5% 16V
U4 TLC2272
C31 0.1 5% 16V
C33 0.1 5% 16V
U10 TLC2272
C30 0.1 5% 16V
C29 0.1 5% 16V
U8 TLC2272
C42 0.1 5% 16V
C44 0.1 5% 16V
U13 TLC2272
VCC
VEE
8
4
C23 0.1 5% 16V
C26 0.1 5% 16V
U7 TLC2272
C15 0.1 5% 16V
C17 0.1 5% 16V
U5 TLC2201
7 VCC NC 8
1 NC NC 5
VEE 4
C40 0.1 5% 16V
C41 0.1 5% 16V
+5ISO
U12 DG413
13 V+
12 VL GND 5
V- 4
C38 10 16V 20%
C37 0.1 5% 16V
C55 0.1 5% 16V
U17 LTC1290
20 V+
11 AGND DGND 10
V- 12
C53 10 16V 20%
C54 0.1 5% 16V
+VISO——+5ISO
F-SHIELD

NOTE: Tie ISOAGND, ISOGND and FSHIELD planes together at pins 13 and 14 of U303. Tie +VISO plane to +5ISO plane near ISOAGND, FSHIELD and ISOGND connection.

8 of 9

LABEL	PAGE COORDINATES
+5:	6-B2,B3,B6,C1,C6,D3,D5,D6
+5ISO:	1-C7,D2,D7 2-A6,B3,B7,C3,D2,D4 3-B1,B2 4-B7,C7,D7 5-A8,B6,C3,C5,D5 6-B8,C7,C8,D7,D8 7-A1,A5,B3
+VDD_SYN:	1-D8 2-A4
+VISO:	3-A4,C3,C4,D8 7-A1,B8
-.64VREF:	3-B5,B8 4-C8 5-A6
-4VREF:	3-B8,C5 5-B5,D8
-VISO:	3-A2,C2,C3 6-A8 7-A8,B8
2.5VREF:	3-D7 5-C8
332_FLOAT:	1-A8 2-C4
4.5VREF:	3-B8,D4
A-D_IR:	3-D2 4-C2
A-D_RED:	3-D2 4-C2
A0:	1-C3,C5 2-D6,D7
A1:	1-C3,C5 2-D6,D7
A2:	1-C3,C5 2-D6,D7
A3:	1-C3,C5 2-D6,D7
A4:	1-C3,C5 2-D6,D7
A5:	1-C3,C5 2-D6,D7
A6:	1-C3,C5 2-C6,D7
A7:	1-C3,C5 2-C6,C7
A8:	1-C3,C5 2-C6,C7
A9:	1-C3,C5 2-C6,C7
A10:	1-C3,D5 2-C6,C7
A11:	1-C3,D5 2-C6,C7
A12:	1-C2,D5 2-C6,C7
A13:	1-C2,D5 2-C6,C7
A14:	1-C2,D5 2-C6,C7
A15:	1-C2,D5 2-C6,C7
A16:	1-C2,D5 2-C6,C7
A17:	1-C2,D5
A18:	1-C2,D5 2-C7
ACK*:	6-C1
AD_ACLK:	1-B2 3-D4
BERR*:	1-A8,B2 2-C2
CAL_OK:	6-B4
D0:	1-B5,C4
D1:	1-B5,D2
D2:	1-B5,D2
D3:	1-B5,D2
D4:	1-B5,D2
D5:	1-B5,D2
D6:	1-B5,D3
D7:	1-B5,D3
D8:	1-C5,D4 2-C5,D6
D9:	1-C5,D4 2-C5,D6
D10:	1-C5,D3 2-C5,D6
D11:	1-C5,D3 2-C5,D6
D12:	1-C5,D3 2-C5,D6
D13:	1-C5,D3 2-C5,D6
D14:	1-C5,D3 2-C5,D6
D15:	1-C5,D3 2-C5,C6
DSCLK:	1-B7 2-D2
DSI:	1-B7 2-D2
DSO:	1-B7 2-D2
EXTAL:	1-A8 2-B6
FLASH_CS*:	1-B8 2-B8
FLASH_WR*:	1-B8 2-B8
FREEZE:	1-C7 2-D2
HALT*:	1-B8,C2
IBF:	6-C1
INTR:	6-C1
INT_DET:	6-C4
IR_ENBL*:	1-B3,C8 4-A5
IR_LED:	3-C2 4-B2
ISO-POWER_EN:	6-C4
ISOAGND:	6-A8
ISOGND:	6-B8
LED_GREEN:	1-D5 2-B8
LED_RED:	1-D5 2-A8
LOADDAC*:	1-A5,C2 4-C8 5-C8
LOW_SAT:	6-B4
LQ_SIG:	6-B4
MODCK:	1-B2,B8
NELLCOR*:	1-D5 5-A4
NEL_IR*:	1-C8 4-C5
NEL_RED*:	1-C8 4-C5
NO_PROBE:	6-B4
OBF*:	6-C1
OHM/NEL*:	1-B5 3-B1
PA0:	6-C1
PA1:	6-C1
PA2:	6-C1
PA3:	6-C1
PA4:	6-C1
PA5:	6-C1
PA6:	6-C1
PA7:	6-D1
POX:	3-D2 5-B1
POX+:	3-C2 5-D8
POX-:	3-C3 5-D8
POX_CLR*:	1-A5,B2 4-C8 5-C8
POX_CTRL0:	1-B4,C8 5-B3
POX_CTRL1:	1-B4,C8 5-B3
POX_EN*:	1-B8 4-D8
POX_ID:	3-C2 5-A1
POX_ID0:	1-D1,D8
POX_ID1:	1-D1,D8
POX_PINT:	3-D2 5-C1
POX_PREAC:	3-D2 5-D1
POX_PWR:	3-C2 4-D2
POX_SUM:	3-C2 5-C1
PRB_SENSE*:	1-B5 3-B1
PROBE_OFF:	6-B4
PULSE:	6-B4
RD/WR*:	1-B4 2-B8
RED_ENBL*:	1-B4,C8 4-B5
RED_LED:	3-B2 4-C2

9 of 9

LABEL	PAGE COORDINATES
RESET*:	1-B8 2-B1,C2
RESTORE*:	1-A5 5-D5
RSENSE:	3-B2 5-A6
RXD_ISO:	1-C8 6-D8
SP02_RESET*:	6-B2
SPARE:	6-C4
SPI_CS0*:	1-C8 3-D4
SPI_CS1*:	1-C8 5-A8
SPI_CS2*:	1-C8 5-C8
SPI_CS3*:	1-C8 4-B8
SPI_MISO:	1-C8 3-D4
SPI_MOSI:	1-C8 3-D4 4-C8 5-C8
SPI_SCLK:	1-C8 3-D4 4-B8 5-C8
SRAM_CS*:	1-B8 2-C8
SRAM_CS2:	1-B2 2-C8
STB*:	6-C1
TEST_MODE*:	6-C4
TXD_ISO:	1-C8 6-C8
WR/RD*:	1-A4 2-B8
XTAL:	1-A8 2-B6

REFDES	PAGE COORDINATES
U1:	4-D6
U2:	4-C3 7-B5
U3:	4-C5,C6 7-B6
U4:	5-D4,D5 7-B4
U5:	5-D7 7-B6
U6:	3-D8
U7:	3-B6,C6 7-B7
U8:	5-C2,C4 7-B3
U9:	5-C6,C7,C8,D7
U10:	5-B7,C6 7-B4
U11:	5-A4,C7 7-B7
U12:	5-B3 7-B5
U13:	3-D6 5-B2 7-B2
U14:	4-C7
U15:	5-C5
U16:	5-B8
U17:	3-D3 7-B4
U18:	1-C3
U19:	1-A4 2-A7,B8 7-C5,C6,C7,C8
U20:	1-B3 7-C3,C8
U21:	1-C3
U22:	1-D3
U23:	2-D5 7-C8
U24:	1-D7 7-C8
U25:	2-B2
U26:	2-D7 7-C8
U27:	6-D7
U28:	6-C7

REFDES	PAGE COORDINATES
U29:	6-D5 7-D8
U30:	6-D2 7-D8
U31:	6-B7
U32:	6-D4
U33:	3-A4

CONNECTOR	SIGNAL
J1-17:	06030065
J1-18:	06054054
J1-19:	06030065
J1-20:	06054054
J1-25:	TEST_MODE*
J1-28:	PA7
J1-30:	PA6
J1-32:	PA5
J1-34:	PA4
J1-36:	PA3
J1-38:	PA2
J1-40:	PA1
J1-41:	SP02_RESET*
J1-42:	PA0
J1-43:	PULSE
J1-44:	OBF*
J1-45:	INT_DET
J1-46:	ACK*
J1-47:	CAL_OK
J1-48:	IBF
J1-49:	SPARE
J1-50:	STB*
J1-51:	LQ_SIG
J1-53:	NO_PROBE
J1-55:	PROBE_OFF
J1-57:	LOW_SAT
J1-61:	+5
J1-62:	+5
J1-63:	GND
J1-64:	GND

CONNECTOR	SIGNAL
J2-1:	POX-
J2-2:	POX+
J2-3:	POX-
J2-4:	FSHIELD
J2-5:	POX_PWR
J2-6:	FSHIELD
J2-7:	IR_LED
J2-8:	FSHIELD
J2-9:	RED_LED
J2-10:	FSHIELD
J2-11:	RSENSE
J2-12:	FSHIELD
J2-13:	03067043
J2-14:	FSHIELD
J2-15:	03067046
J2-16:	FSHIELD
J2-17:	03067053
J2-18:	FSHIELD
J2-19:	ISOGND
J2-20:	FSHIELD
J3-2:	BERR*
J3-3:	ISOGND
J3-4:	DSCLK
J3-5:	ISOGND
J3-6:	FREEZE
J3-7:	RESET*
J3-8:	DSI
J3-9:	02086029
J3-10:	DSO
J4-1:	ISOAGND
J4-2:	-4VREF
J4-3:	-.64VREF
J4-4:	4.5VREF

For your notes